(54) LIQUID CRYSTAL DISPLAY METHOD AND LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To improve the display quality of a moving picture by the minimum improvement.

SOLUTION: Source drivers 12 outputs a data signal and a reset (black) signal alternately to source lines S. 480 lines of gate lines G are connected to gate line drivers 13a to 13c while being divided into three groups by every 160 lines. A display control part 20 makes the drivers select (n)th gate lines G when the source drivers 12 output a data signal and makes them select (n+160)th gate lines G when the drivers 12 output the reset signal by outputting the identification signal, the scanning starting signal and the clock signal to respective gate drivers 13a to 13c. Moreover, the part 20 makes the drivers 13a to 13c shift (n) successively. This device eliminates light leakagte of picture elements which are changed over from white display to black display by writing the reset signal in one-third the latter half of a frame in this manner. Moreover, the device reduces blots of the edge part of a moving image. Thus, the display quality of the moving picture is improved by the minimum improvement.
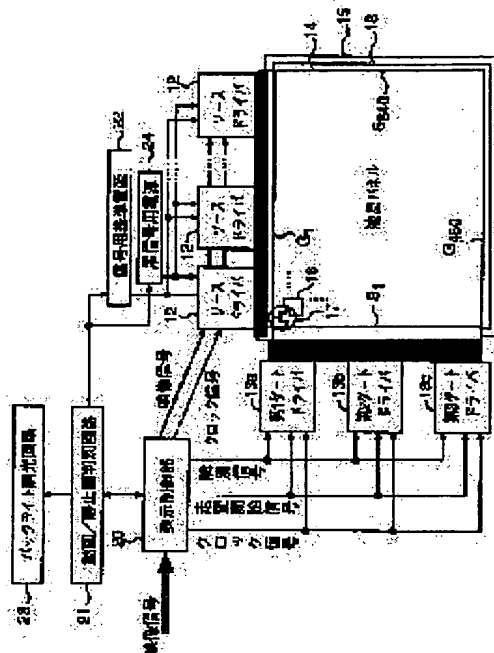
* NOTICES *

CLAIMS

[Claim(s)]

[Claim 1]Supply a data signal to two or more lines arranged in parallel mutually, and a selection signal is supplied to two or more column lines mutually arranged in parallel in the direction which intersects the above-mentioned line, It is a liquid crystal display method which displays a picture on a picture element which becomes with a liquid crystal an intersecting position of a line with which the above-mentioned data signal was supplied, and a column line with which the above-mentioned selection signal was supplied, or near the intersecting position, Supply the above-mentioned selection signal to a column line of n (n: positive integer) flat knot, and a data signal is supplied to the above-mentioned line, Display a picture based on the above-mentioned data signal on a picture element concerning an intersecting position of a column line of the above-mentioned n flat knot, and each line, supply the above-mentioned selection signal to a column line of a flat knot (n+m) by making m into a positive integer, and. A black status signal for displaying a black image on a picture element is supplied to the above-mentioned line, The above-mentioned black image is displayed on a picture element concerning an intersecting position of a column line of the above-mentioned (n+m) flat knot, and each line, A display action of a picture based on the above-mentioned data signal and a display action of a black image are repeated shifting a column line which supplies the above-mentioned selection signal one by one, A liquid crystal display method returning to a head line line and displaying a picture and a black image based on the above-mentioned data signal to each of all the picture elements within 1 frame period when a column line of a flat knot (n+m) which supplies the above-mentioned selection signal exceeds a final line line.

[Claim 2]Supply a data signal to two or more lines arranged in parallel mutually, and a selection signal is supplied to two or more column lines mutually arranged in parallel in the direction which intersects the above-mentioned line, Are a liquid crystal display method which displays a picture on a picture element which becomes with a liquid crystal an intersecting position of a line with which the above-mentioned data signal was supplied, and a column line with which the above-mentioned selection signal was supplied, or near the intersecting position, and supply the above-mentioned selection signal to a column line of n flat knot, and. Supply the above-mentioned selection signal to two or more column lines which supply a data signal to the above-mentioned line, and display a picture based on the above-mentioned data signal on a picture element concerning an intersecting position of a column line of the above-mentioned n flat knot, and each line, next are different from a column line of the above-mentioned n flat knot simultaneously, and. The above-mentioned black status signal for displaying a black image on a picture element is supplied to the above-mentioned line, The above-mentioned black image is displayed on a picture element concerning an intersecting position of two or more above-mentioned column line and each line, A display action of a picture based on the above-mentioned data signal and a display action of a black image are repeated shifting a column line which supplies the above-mentioned selection signal one by one, A liquid crystal display method returning to a head line line and displaying a picture and a black image based on the above-mentioned data signal to each of all the picture elements within 1 frame period when two or more column lines which supply a selection signal to the above-mentioned coincidence exceed a final line line.

[Claim 3]A liquid crystal display method characterized by two or more above-mentioned column lines being column lines of a flat knot (alpha$(n+alpha-m)$ = 1, 2, --, p (p: positive integer)) in the liquid crystal display method according to claim 2.

[Claim 4]A liquid crystal display method characterized by two or more above-mentioned column lines being column lines from a flat knot $(n+alpha-m)$ $(n+alpha-m+k-1)$ (alpha= 1, 2, --, p (p, k: positive integer)) to a flat knot in the liquid crystal display method according to claim 2.

[Claim 5]A liquid crystal display method characterized by feed time of the above-mentioned data signal and feed time of the above-mentioned black status signal being equal in any of claim 1 thru/or claim 4, or a liquid crystal display method of one statement.

[Claim 6]A liquid crystal display method with which feed time of the above-mentioned data signal is characterized by a long time rather than feed time of the above-mentioned black status signal in any of claim 1 thru/or claim 4, or a liquid crystal display method of one statement.

[Claim 7]A liquid crystal display method, wherein a value of the above-mentioned m is set up in any of claim 1, claim 3, and claim 4, or a liquid crystal display method of one statement fill a relation of a following formula.

$fxm/N>t$, however N:several f column-line:one-frame-time t: Response time of a liquid crystal at the time of switching a white display to a black display [Claim 8]A liquid crystal display method, wherein a value of the above-mentioned k is set up in the liquid crystal display method according to claim 4 fill a relation of a following formula.

$Txk>=T_0$, however 1 time of feed-time T_0 of T:black status signal: Shortest time of a black status signal which can switch a white display to a black display thoroughly [Claim 9]A liquid crystal display method setting up the voltage Vd in case the above-mentioned data signal is a data signal for a black display, and the voltage Vr of the above-mentioned black status signal in any of claim 1 thru/or claim 4, or a liquid crystal display method of one statement fill the following relation. In the case of negative polarity, it is [as opposed to / in a case of straight polarity / a potential level of a $Vd>Vr$ counterelectrode] $Vd<Vr$ to a potential level of a counterelectrode at the time of a $Vd>Vr$ normally black at the time of a normally white at the time of a $Vd<Vr$ normally black at the time of a normally white. [Claim 10]A display panel in which a picture element which becomes with a liquid crystal an intersecting position of two or more lines arranged in parallel mutually, two or more column lines mutually arranged in parallel in the direction which intersects the above-mentioned column electrode, the above-mentioned line, and the above-mentioned column line, or near the intersecting position was formed at least.
A line driver who supplies a data signal to the above-mentioned line, and a column line driver who supplies a selection signal to the above-mentioned column line.
Are the liquid crystal display provided with the above, and while supplying a video signal and a control signal to the above-mentioned line driver, a control signal is supplied to the above-mentioned column line driver, A display control part which controls picture displaying operation to the above-mentioned display panel, and a black status signal generating means which generates a black status signal for displaying a black image on the above-mentioned picture element, It is provided in the above-mentioned line driver, and has a changeover switch which changes a data signal and a black status signal from the above-mentioned black status signal generating means based on a video signal from the above-mentioned display control part by turns, and chooses them, The above-mentioned display control part supplies the above-mentioned control signal for making the above-mentioned column line choose one by one to the above-mentioned column line driver, and. When the above-mentioned changeover switch has chosen a black status signal, a column line of a flat knot is made to supply a selection signal, while making a column line of n flat knot supply a selection signal, when the above-mentioned changeover switch has chosen a data signal (n+m).

[Claim 11]A display panel in which a picture element which becomes with a liquid crystal an intersecting position of two or more lines arranged in parallel mutually, two or more column lines mutually arranged in parallel in the direction which intersects the above-mentioned column electrode, the above-mentioned line, and the above-mentioned column line, or near the intersecting position was formed at least.
A line driver who supplies a data signal to the above-mentioned line, and a column line driver who supplies a selection signal to the above-mentioned column line.
Are the liquid crystal display provided with the above, and while supplying a video signal and a control signal to the above-mentioned line driver, a control signal is supplied to the above-mentioned column line driver, A display control part which controls picture displaying operation to the above-mentioned display panel, and a black status signal generating means which generates a black status signal for displaying a black image on the above-mentioned picture element, It is provided in the above-mentioned line driver, and has a changeover switch which changes a data signal and a black status signal from the above-mentioned black status signal generating means based on a video signal from the above-mentioned display control part by turns, and chooses them, The above-mentioned display control part supplies the above-mentioned control signal for making the above-mentioned column line choose one by one to the

above-mentioned column line driver, and. When the above-mentioned changeover switch has chosen a black status signal, two or more different column lines from a column line of the above-mentioned n flat knot are made to supply a selection signal, while making a column line of n flat knot supply a selection signal, when the above-mentioned changeover switch has chosen a data signal.

[Claim 12]A liquid crystal display, wherein the above-mentioned column line is divided into a block of L (L: positive integer) individual for every m book and the above-mentioned column line driver comprises L partial column line drivers who supply a selection signal to a column line of each block in claim 10 or the liquid crystal display according to claim 11.
[Claim 13]In any of claim 10 thru/or claim 12, or a liquid crystal display of one statement, a control signal from the above-mentioned display control part to the above-mentioned line driver, A liquid crystal display characterized by the above-mentioned switching control signal making selection time of the above-mentioned data signal longer than selection time of a black status signal including a switching control signal for controlling switching operation of the above-mentioned changeover switch.
[Claim 14]In any of claim 10 thru/or claim 12, or a liquid crystal display of one statement, a control signal from the above-mentioned display control part to the above-mentioned line driver, A liquid crystal display characterized by the above-mentioned switching control signal making equal selection time of the above-mentioned data signal, and selection time of the above-mentioned black status signal including a switching control signal for controlling switching operation of the above-mentioned changeover switch.
[Claim 15]In claim 11 or the liquid crystal display according to claim 12, a control signal from the above-mentioned display control part to the above-mentioned column line driver, Whether it is the black status signal days of supply which supply the above-mentioned black status signal including a recognition signal for identifying the above-mentioned column line driver, A liquid crystal display characterized by supplying the above-mentioned selection signal to a column line from a flat knot (n+m+k-1) to a flat knot at the above-mentioned black status signal days of supply (n+m) based on the above-mentioned recognition signal.
[Claim 16]The liquid crystal display comprising according to claim 15:
A shift register in which, as for a control signal from the above-mentioned display control part to the above-mentioned column line driver, the above-mentioned column line driver has two or more latch circuitry including a scanning start signal.
While supplying the above-mentioned scanning start signal to the 1st latch circuitry of the above-mentioned shift register at the data signal days of supply based on the above-mentioned recognition signal, A scan start signal supply means which supplies the above-mentioned scanning start signal to k latch circuitry which continued from the m-th latch circuitry of the above-mentioned shift register at the black status signal days of supply.

[Claim 17]A liquid crystal display, wherein change of the latch circuitry number m and the number k of latch circuitry in the above-mentioned black status signal days of supply of the above-mentioned scan start signal supply means is attained in the liquid crystal display according to claim 16.
[Claim 18]In the liquid crystal display according to claim 17, have a supply control means to control operation of the above-mentioned scan start signal supply means, and the above-mentioned supply control means, A liquid crystal display outputting a control signal which sets up the above-mentioned latch circuitry number m to the above-mentioned scan start signal supply means based on a scan start tab-control-specification signal from the outside.
[Claim 19]In any of claim 10 thru/or claim 12, or a liquid crystal display of one statement, the above-mentioned display control part, A control signal for the 1st display mode which performs supply operation of a black status signal based on operation of the above-mentioned changeover switch according to a command signal from the outside, A liquid crystal display switching and outputting a control signal for the 2nd display mode which the above-mentioned changeover switch carries out an operation stop, and does not perform supply operation of a black status

signal.

[Claim 20]Have a reference supply for signals for setting up voltage of a data signal supplied from the above-mentioned line driver in the liquid crystal display according to claim 19, and voltage of the above-mentioned reference supply for signals, A liquid crystal display, wherein a change has become possible in the time of the 1st display mode of the above, and the 2nd display mode.

[Claim 21]In the liquid crystal display according to claim 19, data applied to the same position on a screen based on a video signal from the above-mentioned display control part is monitored, A liquid crystal display provided with an animation still picture discriminating means which outputs the above-mentioned command signal which distinguishes whether pictures based on the above-mentioned video signal are whether it is an animation and a still picture, and with which a discriminated result is expressed to the above-mentioned display control part.

[Claim 22]Any of claim 19 thru/or claim 21 characterized by comprising the following, or a liquid crystal display of one statement.
A back light which irradiates with the above-mentioned display panel from the rear-face side.
A back light control means which switches luminosity of the above-mentioned back light with the 1st display mode of the above, and the 2nd display mode based on the above-mentioned command signal.

[Claim 23]A liquid crystal display which the above-mentioned black status signal generating means is a power supply for black status signals in the liquid crystal display according to claim 19, and is characterized by having attained a change of voltage of the above-mentioned power supply for black status signals in the time of the 1st display mode of the above, and the 2nd display mode of the above.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to a liquid crystal display method and a liquid crystal display excellent in animation display.
[0002]
[Description of the Prior Art]Conventionally, there is an active-matrix type liquid crystal display. In a this active-matrix type liquid crystal display, as shown in drawing 31, whenever it samples the data for 1 horizontal line from a video signal to the sampling memory 2, this sampled data is stored in the holding memory 3 with the source driver 1. One [the liquid crystal panel side / a horizontal line / the horizontal line which becomes in the picture element line which should write in data is chosen by a gate driver (not shown), and / TFT (thin film transistor) of the selected picture element]. Then, the DA translation of the data signal for 1 horizontal line currently stored in the holding memory 3 is carried out to all the picture elements which constitute the

selected horizontal line by DA converter 4, and it is written in them via the source line 6.
[0003]Above-mentioned operation is performed to all the horizontal lines, and the image writing of one screen is completed. And the display of various images is enabled by repeating this as one frame. The active matrix type liquid crystal display which performs such a display action is applied to a word processor, the indicator of a notebook computer, or television.
[0004]By the way, in an above-mentioned active-matrix [conventional] type liquid crystal display, since [which is time for the speed of response of a liquid crystal, especially the speed of response between intermediate color to be the one above-mentioned frame] it is later than 16.7 ms, in animation display, there is a problem of display quality fall that an afterimage is seen.
[0005]The data signal written in the picture element to which the above TFT corresponds between non selections continues being held. Therefore, even if it makes quick speed of response of a metaphor liquid crystal, although human being's look pursues an animation, the afterimage on the retina of a reason exists. As a result, there is also a problem that display quality falls.
[0006]Then, in order to solve each above-mentioned problem, the following liquid crystal display methods are proposed (the literature 1 and literature 2). In the literature 1 "JP,11-109921,A", a screen is divided up-and-down 2, and the black signal (blanking) scan of the lower screen is carried out in the first half of frame time at the same time it carries out the signal scan of the upper screen. And it is made to carry out the signal scan of the lower screen in the second half of frame time at the same time it carries out the black signal (blanking) scan of the above top screen.
[0007]In the literature 2 ""LCD corresponding to new animation which used pie cell" Japanese Liquid Crystal Society, 1999, vol.3, No.2", a screen is divided up-and-down 2, and one frame time is divided into the time slot of the line number of the full screen. And in the 1st slot, a lower screen also carries out a signal scan at the same time it carries out the signal scan of the upper screen. In the 2nd slot, the lower screen is also made to perform a black signal (blanking) scan at the same time it carries out the black signal (blanking) scan of the above top screen. Thus, the signal scan and the black signal (blanking) scan are successively repeated for every slot.
[0008]According to each above-mentioned liquid crystal display method, if its attention is paid to one picture element, both an image display period and a black display period are always in one frame time, and it will become possible to display a picture, without intermingling the frame data of order especially by existence of a black display period. Therefore, the display performance of the animation is improvable.
[0009]
[Problem(s) to be Solved by the Invention]However, there are the following problems in the liquid crystal display method indicated by the above-mentioned literature 2. That is, one frame time is divided into the time slot of the line number of the full screen, and the screen is divided further up-and-down 2. And in the 1st slot, a lower screen also carries out a signal scan at the same time it carries out the signal scan of the upper screen. On the other hand, in the 2nd slot, the lower screen is also carrying out the black signal (blanking) scan at the same time it carries out the black signal (blanking) scan of the above top screen. Thus, the signal scan and the black signal (blanking) scan are successively repeated for every slot. Therefore, when beginning to scan an upper screen, it is necessary to also scan a lower screen simultaneously, and it is necessary to make the image data for one line memorize once. Therefore, a circuit is complicated and there is a problem that it is connected with a cost hike.
[0010]The liquid crystal display method indicated by the above-mentioned literature 1 also has the same problem. That is, one frame time is divided at the first half and the second half, and the screen is divided further up-and-down 2. And the black signal (blanking) scan of the lower screen is carried out in the first half of one frame time at the same time it carries out the signal scan of the upper screen. On the other hand, the signal scan of the lower screen is carried out in the second half of one frame time at the same time it carries out the black signal (blanking) scan of the upper screen. In this case, although memory of image data like the above-mentioned literature 2 is unnecessary, the fault of the complication and cost hike of a circuit by a screen separation is produced too.

[0011]Although it is needless to say, if a screen is divided, it will be [a source driver] necessary twice by the upper and lower sides, and it will become a cost hike, for example.

[0012]Then, there is a screen separation [like the literature 1 and the literature 2] whose purpose of this invention is in providing the liquid crystal display method and liquid crystal display which can improve animation display grace by improvement of the minimum of the conventional liquid crystal display, without also needing the memory storage of a special screen, without carrying out.

[0013]

[Means for Solving the Problem]In order to attain the above-mentioned purpose, the 1st invention supplies a data signal to two or more lines arranged in parallel mutually, and a selection signal is supplied to two or more column lines mutually arranged in parallel in the direction which intersects the above-mentioned line, It is a liquid crystal display method which displays a picture on a picture element which becomes with a liquid crystal an intersecting position of a line with which the above-mentioned data signal was supplied, and a column line with which the above-mentioned selection signal was supplied, or near the intersecting position, Supply the above-mentioned selection signal to a column line of n (n: positive integer) flat knot, and a data signal is supplied to the above-mentioned line, Display a picture based on the above-mentioned data signal on a picture element concerning an intersecting position of a column line of the above-mentioned n flat knot, and each line, supply the above-mentioned selection signal to a column line of a flat knot (n+m) by making m into a positive integer, and. A black status signal for displaying a black image on a picture element is supplied to the above-mentioned line, Display the above-mentioned black image on a picture element concerning an intersecting position of a column line of the above-mentioned (n+m) flat knot, and each line, and a display action of a picture based on the above-mentioned data signal and a display action of a black image are repeated, shifting a column line which supplies the above-mentioned selection signal one by one, When a column line of a flat knot (n+m) which supplies the above-mentioned selection signal exceeds a final line line, it is characterized by returning to a head line line and displaying a picture and a black image based on the above-mentioned data signal to each of all the picture elements within 1 frame period.

[0014]According to the above-mentioned composition, unlike a case of the above-mentioned literature 1 and the literature 2, data signal supply to a line and black status signal supply are performed by turns, and n is increased for a column line which supplies the above-mentioned selection signal one by one synchronizing with the above-mentioned signal supply like n, n+m, n+1, n+m+1, n+2, n+m+2, and --. In this way, all the picture elements are received, without dividing a screen or using a circuit which memorizes image data of one screen, The state where a black status signal was written in is held until a data signal is written in, a black status signal is supplied and an image data signal is newly written in the following frame, after predetermined time according to m passes further, and a black image is displayed. Therefore, when a picture element which is performing a white display changes to a black display with the following frame, before a black status signal is written in, a black image will already be displayed, and optical leakage of a back light does not take place.

[0015]Edge of an image in an animation moved by end change of a frame, and has stopped at a frame period. However, there is a period which human being has in a period which has edge of an image ahead of human being's look since it is sensed that an image is moving smoothly, and the back, and edge of an image spreads and it is visible. However, since a picture element which shows the above-mentioned image will become a black display as mentioned above in this invention by the time a data signal is impressed next, and an image disappears, A period which has edge of an image ahead of human being's look as a result, and a period in behind become short, and a blot of edge of an image will be reduced. In this way, animation display grace improves.

[0016]The 2nd invention supplies a data signal to two or more lines arranged in parallel mutually, and a selection signal is supplied to two or more column lines mutually arranged in parallel in the direction which intersects the above-mentioned line, Are a liquid crystal display method which displays a picture on a picture element which becomes with a liquid crystal an intersecting

position of a line with which the above-mentioned data signal was supplied, and a column line with which the above-mentioned selection signal was supplied, or near the intersecting position, and supply the above-mentioned selection signal to a column line of n flat knot, and. Supply the above-mentioned selection signal to two or more column lines which supply a data signal to the above-mentioned line, and display a picture based on the above-mentioned data signal on a picture element concerning an intersecting position of a column line of the above-mentioned n flat knot, and each line, next are different from a column line of the above-mentioned n flat knot simultaneously, and. A black status signal for displaying a black image on a picture element is supplied to the above-mentioned line, The above-mentioned black image is displayed on a picture element concerning an intersecting position of two or more above-mentioned column line and each line, A display action of a picture based on the above-mentioned data signal and a display action of a black image are repeated shifting a column line which supplies the above-mentioned selection signal one by one, When two or more column lines which supply a selection signal to the above-mentioned coincidence exceed a final line line, it is characterized by returning to a head line line and displaying a picture and a black image based on the above-mentioned data signal to each of all the picture elements within 1 frame period.

[0017]According to the above-mentioned composition, a multiple-times black status signal is supplied to all the picture elements in the second half of 1 frame period. Therefore, even when it is the time which cannot perform black image display with the above-mentioned black status signal feed time sufficient by just one black status signal supply, a black display is ensured by repeating black status signal supply two or more times. In this way, picture element density of a display panel is high density, and since there are many column lines, even when black status signal feed time cannot be taken enough, high-definition animation display to which optical leakage of a back light does not take place is performed.

[0018]As for a liquid crystal display method of an invention of the above 2nd, it is desirable to make two or more above-mentioned column lines into a column line of a flat knot (alpha($_{n+alpha-m}$) = 1, 2, --, p (p: positive integer)).

[0019]According to the above-mentioned composition, when its attention is paid to one certain horizontal line, a black display will be repeatedly performed for every scan of m book. in this way -- losing influence of a dielectric constant of a liquid crystal by display information of the last frame -- a pan -- a high-definition display is performed.

[0020]As for a liquid crystal display method of an invention of the above 2nd, it is desirable to make two or more above-mentioned column lines into a column line from a flat knot ($_{n+alpha-m}$) ($_{n+alpha-m+k}$-1) (alpha= 1, 2, --, p (p, k: positive integer)) to a flat knot.

[0021]According to the above-mentioned composition, if its attention is paid to one certain horizontal line, a black display will be repeatedly performed k times for every scan of m book, and influence of display information of the last frame will be lost further.

[0022]As for a liquid crystal display method of the 1st above-mentioned invention or the 2nd invention, it is desirable to make equal feed time of the above-mentioned data signal and feed time of the above-mentioned black status signal.

[0023]According to the above-mentioned composition, since feed time of the above-mentioned data signal and feed time of the above-mentioned black status signal are equal, supply of the above-mentioned data signal and supply of the above-mentioned black status signal are switched by very easy switching control processing.

[0024]As for a liquid crystal display method of the 1st above-mentioned invention or the 2nd invention, it is desirable to make feed time of the above-mentioned data signal longer than feed time of the above-mentioned black status signal.

[0025]According to the above-mentioned composition, picture element density of a display panel is high density, and since there are many column lines, it can be coped with also when data signal feed time cannot be taken enough.

[0026]As for a liquid crystal display method of the 1st above-mentioned invention or the 2nd invention, it is desirable to set up a value of the above-mentioned m fill a relation of a following formula.

fxm/N>t, however N:several f column-line:one-frame-time t: Response time of a liquid crystal at

the time of switching a white display to a black display [0027]According to the above-mentioned composition, feed time of the above-mentioned black status signal in 1 frame period is set up more than response time of a liquid crystal in a case of switching a white display to a black display. In this way, a black display will be ensured by the time a data signal is impressed next, even if it is a picture element as which a white image is displayed based on the above-mentioned data signal.

[0028]As for a liquid crystal display method of the 1st above-mentioned invention or the 2nd invention, it is desirable to set up a value of the above-mentioned k fill a relation of a following formula.

$Txk>=T_0$, however 1 time of feed-time T_0 of T:black status signal: Shortest time of a black status signal which can switch a white display to a black display thoroughly [0029]According to the above-mentioned composition, feed time of the above-mentioned black status signal in 1 frame period is set up beyond shortest time which can switch a white display to a black display by k times supply of a black status signal. In this way, since feed time of the above-mentioned black status signal is insufficient, when repeating a black status signal k times and supplying it, a black display will be ensured by the time a data signal is impressed next, even if it is a picture element as which a white image is displayed based on the above-mentioned data signal.

[0030]As for a liquid crystal display method of the 1st above-mentioned invention or the 2nd invention, it is desirable to set up the voltage Vd in case the above-mentioned data signal is a data signal for a black display, and the voltage Vr of the above-mentioned black status signal fill the following relation. To a potential level of a counterelectrode, Vd<Vr is received at the time of a normally white, and it receives at a potential level of a Vd>Vr counterelectrode at the time of a normally black in the case of straight polarity, and, in the case of negative polarity, is Vd<Vr at the time of a Vd>Vr normally black at the time of a normally white. [0031]Even when according to the above-mentioned composition feed time of a black status signal is insufficient and sufficient black display cannot be performed, a black display is ensured by setting voltage of the above-mentioned black status signal as (smallish) in a slight size.

[0032]The 3rd invention, A display panel in which a picture element which becomes with a liquid crystal an intersecting position of two or more lines arranged in parallel mutually, two or more column lines mutually arranged in parallel in the direction which intersects the above-mentioned column electrode, the above-mentioned line, and the above-mentioned column line, or near the intersecting position was formed at least, In a liquid crystal display which has a line driver who supplies a data signal to the above-mentioned line, and a column line driver who supplies a selection signal to the above-mentioned column line, While supplying a video signal and a control signal to the above-mentioned line driver, a control signal is supplied to the above-mentioned column line driver, A display control part which controls picture displaying operation to the above-mentioned display panel, and a black status signal generating means which generates a black status signal for displaying a black image on the above-mentioned picture element, It is provided in the above-mentioned line driver, and has a changeover switch which changes a data signal and a black status signal from the above-mentioned black status signal generating means based on a video signal from the above-mentioned display control part by turns, and chooses them, The above-mentioned display control part supplies the above-mentioned control signal for making the above-mentioned column line choose one by one to the above-mentioned column line driver, and. When the above-mentioned changeover switch has chosen a data signal, while making a column line of n flat knot supply a selection signal, when the above-mentioned changeover switch has chosen a black status signal, it is characterized by making a column line of a flat knot supply a selection signal (n+m).

[0033]According to the above-mentioned composition, based on a control signal from display control, a column line driver and a line driver are controlled as follows. That is, when a data signal is chosen and a line is supplied with a changeover switch of the above-mentioned line driver, a column line of n flat knot is chosen by the above-mentioned column line driver. On the other hand, when a black status signal is chosen and a line is supplied with the above-mentioned changeover switch, a column line of a flat knot (n+m) is chosen. In this way, the state where a black status signal was written in is held until a data signal is written in, a black status signal is

supplied and an image data signal is newly written in the following frame to all the picture elements, after predetermined time according to m passes further, and a black image is displayed. Therefore, when a picture element which is performing a white display changes to a black display with the following frame, before a black status signal is written in, a black image will already be displayed, and optical leakage of a back light does not take place.

[0034]The 4th invention, A display panel in which a picture element which becomes with a liquid crystal an intersecting position of two or more lines arranged in parallel mutually, two or more column lines mutually arranged in parallel in the direction which intersects the above-mentioned column electrode, the above-mentioned line, and the above-mentioned column line, or near the intersecting position was formed at least, In a liquid crystal display which has a line driver who supplies a data signal to the above-mentioned line, and a column line driver who supplies a selection signal to the above-mentioned column line, While supplying a video signal and a control signal to the above-mentioned line driver, a control signal is supplied to the above-mentioned column line driver, A display control part which controls picture displaying operation to the above-mentioned display panel, and a black status signal generating means which generates a black status signal for displaying a black image on the above-mentioned picture element, It is provided in the above-mentioned line driver, and has a changeover switch which changes a data signal and a black status signal from the above-mentioned black status signal generating means based on a video signal from the above-mentioned display control part by turns, and chooses them, The above-mentioned display control part supplies the above-mentioned control signal for making the above-mentioned column line choose one by one to the above-mentioned column line driver, and. When the above-mentioned changeover switch has chosen a data signal, while making a column line of n flat knot supply a selection signal, when the above-mentioned changeover switch has chosen a black status signal, it is characterized by making two or more different column lines from a column line of the above-mentioned n flat knot supply a selection signal.

[0035]According to the above-mentioned composition, based on a control signal from display control, a column line driver and a line driver are controlled as follows. That is, when a data signal is chosen and a line is supplied with a changeover switch of the above-mentioned line driver, a column line of n flat knot is chosen by the above-mentioned column line driver. On the other hand, when a black status signal is chosen and a line is supplied with the above-mentioned changeover switch, two or more different column lines from n flat knot are chosen. Therefore, even when it is the time which cannot perform black image display with the above-mentioned black status signal feed time sufficient by just one black status signal supply, a black display is ensured by repeating black status signal supply two or more times. In this way, picture element density of a display panel is high density, and since there are many column lines, even when black status signal feed time cannot be taken enough, high-definition animation display to which optical leakage of a back light does not take place is performed.

[0036]As for a liquid crystal display of the 3rd above-mentioned invention or the 4th invention, it is desirable to constitute from L partial column line drivers who divide the above-mentioned column line into a block of L (L: positive integer) individual for every m book, and supply a selection signal to a column line of each block of the above-mentioned column line driver.

[0037]According to the above-mentioned composition, when a data signal is supplied to a line with the above-mentioned changeover switch, a column line of n flat knot connected to the partial column line driver concerned is chosen by one certain partial column line driver. On the other hand, when a black status signal is supplied to a line with the above-mentioned changeover switch, a column line of n flat knot connected to the partial column line driver concerned is chosen by a partial column line driver located in the back row of the above-mentioned partial column line driver. In this way, selection operation of a column line of a book (n+m) is performed by easy control.

[0038]A liquid crystal display of the 3rd above-mentioned invention or the 4th invention, It is desirable for the above-mentioned switching control signal to make selection time of the above-mentioned data signal longer than selection time of a black status signal including a switching control signal for a control signal from the above-mentioned display control part to the above-

mentioned line driver to control switching operation of the above-mentioned changeover switch.

[0039]According to the above-mentioned composition, feed time of the above-mentioned data signal becomes longer than feed time of the above-mentioned black status signal. Therefore, picture element density of a display panel is high density, and since there are many column lines, it can be coped with also when data signal feed time cannot be taken enough.

[0040]A liquid crystal display of the 3rd above-mentioned invention or the 4th invention, It is desirable for the above-mentioned switching control signal to make equal selection time of the above-mentioned data signal and selection time of the above-mentioned black status signal including a switching control signal for a control signal from the above-mentioned display control part to the above-mentioned line driver to control switching operation of the above-mentioned changeover switch.

[0041]According to the above-mentioned composition, since feed time of the above-mentioned data signal and feed time of the above-mentioned black status signal are equal, supply of the above-mentioned data signal and supply of the above-mentioned black status signal are switched by very easy switching control processing.

[0042]A liquid crystal display of an invention of the above 4th a control signal from the above-mentioned display control part to the above-mentioned column line driver, Whether it is the black status signal days of supply which supply the above-mentioned black status signal including a recognition signal for identifying the above-mentioned column line driver, It is desirable to supply the above-mentioned selection signal to a column line from a flat knot (n+m+k-1) to a flat knot at the above-mentioned black status signal days of supply based on the above-mentioned recognition signal (n+m).

[0043]According to the above-mentioned composition, a black status signal is supplied k times to all the picture elements into predetermined time corresponding to m by the time a data signal was impressed next. Therefore, in order for black status signal feed time according to the above-mentioned m to perform a black image display, even when it is insufficient time, a black display is ensured by repeating black status signal supply k times. In this way, picture element density of a display panel is high density, and since there are many column lines, even when black status signal feed time cannot be taken enough, high-definition animation display to which optical leakage of a back light does not take place is performed.

[0044]A liquid crystal display invention of an invention of the above 4th, A control signal from the above-mentioned display control part to the above-mentioned column line driver including a scanning start signal the above-mentioned column line driver, A shift register which has two or more latch circuitry, Based on the above-mentioned recognition signal, At the data signal days of supply the above-mentioned scanning start signal. While supplying the 1st latch circuitry of the above-mentioned shift register, it is desirable to prepare for the black status signal days of supply a scan start signal supply means which supplies the above-mentioned scanning start signal to k latch circuitry which continued from the m-th latch circuitry of the above-mentioned shift register.

[0045]According to the above-mentioned composition, a column line driver who can supply a black status signal k times by the time a data signal is impressed next is realized with easy composition which provides a scan start signal supply means in a column line driver which has a shift register.

[0046]As for a liquid crystal display of an invention of the above 4th, it is desirable to accomplish the above-mentioned scan start signal supply means so that change of the latch circuitry number m and the number k of latch circuitry in the above-mentioned black status signal days of supply is possible.

[0047]According to the above-mentioned composition, time to display a black image by the time a data signal is impressed next is changed by changing the latch circuitry number m. The number of times to which a black status signal will be supplied by the time a data signal is impressed next is changed by changing the number k of latch circuitry.

[0048]A liquid crystal display of an invention of the above 4th is provided with a supply control means to control operation of the above-mentioned scan start signal supply means, and the above-mentioned supply control means, It is desirable to output a control signal which sets up

the above-mentioned latch circuitry number m to the above-mentioned scan start signal supply means based on a scan start tab-control-specification signal from the outside.

[0049]According to the above-mentioned composition, time to display a black image based on a signal from the outside, by the time a data signal is impressed next is changed.

[0050]A liquid crystal display of the 3rd above-mentioned invention or the 4th invention, A control signal for the 1st display mode which performs supply operation of a black status signal based on [according to a command signal from the outside] operation of the above-mentioned changeover switch for the above-mentioned display control part, It is desirable to accomplish so that a control signal for the 2nd display mode which the above-mentioned changeover switch carries out an operation stop, and does not perform supply operation of a black status signal may be switched and outputted.

[0051]The 1st display mode with which according to the above-mentioned composition energy consumption increases in order that a display mode may supply a black status signal to the above-mentioned line based on operation of the above-mentioned changeover switch for every frame, Energy consumption is switched to few 2nd usual display mode, and waste of energy by always fixing a display mode to the 1st mode of the above is prevented.

[0052]A liquid crystal display of the 3rd above-mentioned invention or the 4th invention, It has a reference supply for signals for setting up voltage of a data signal supplied from the above-mentioned line driver, and, as for voltage of the above-mentioned reference supply for signals, it is desirable for a change to have become possible in the time of the 1st display mode of the above and the 2nd display mode.

[0053]According to the above-mentioned composition, after the above-mentioned data signal is written in, a black status signal is supplied, In order to display a black image before an image data signal is newly written in the following frame, when transmissivity of a liquid crystal is the 1st display mode that becomes low, voltage of a reference supply for signals is switched and voltage of a data signal is set up according to a transmissivity fall of the above-mentioned liquid crystal. In this way, fixed gradation balance is maintained between the 1st display mode and the 2nd display mode.

[0054]A liquid crystal display of the 3rd above-mentioned invention or the 4th invention, It is desirable to have an animation still picture discriminating means which outputs the above-mentioned command signal which monitors data applied to the same position on a screen based on a video signal from the above-mentioned display control part, and distinguishes whether pictures based on the above-mentioned video signal are whether it is an animation and a still picture, and with which a discriminated result is expressed to the above-mentioned display control part.

[0055]According to the above-mentioned composition, based on the above-mentioned video signal, it is distinguished by animation still picture discriminating means whether it is an animation or it is a still picture, and a command signal showing a discriminated result is outputted to the above-mentioned display control part. In this way, after a control signal for the 1st display mode is automatically outputted from the above-mentioned display control part and a data signal is written in 1 frame period at the time of animation display to which display quality falls easily, by the time a data signal is impressed to the following frame, a black image will be displayed, and display quality improves.

[0056]As for a liquid crystal display of the 3rd above-mentioned invention or the 4th invention, it is desirable a back light which irradiates with the above-mentioned display panel from the rear-face side, and to have a back light control means which switches luminosity of the above-mentioned back light with the 1st display mode of the above and the 2nd display mode based on the above-mentioned command signal.

[0057]In order to display a black image according to the above-mentioned composition until a data signal is impressed to the following frame in 1 frame period after a data signal is written in, when transmissivity of a liquid crystal is the 1st display mode that becomes low, Luminosity of a back light is raised by back light control means, and when it is the 2nd usual display mode, luminosity of a back light is lowered. In this way, waste of energy by always raising luminosity of the above-mentioned back light is prevented.

[0058]As for a liquid crystal display of the 3rd above-mentioned invention or the 4th invention, it is desirable to constitute the above-mentioned black status signal generating means from a power supply for black status signals, and to accomplish voltage of the above-mentioned power supply for black status signals in the time of the 1st display mode of the above and the 2nd display mode of the above, so that a change is possible.

[0059]According to the above-mentioned composition, in 1 frame period, in the case of the 1st display mode that displays a black image until a data signal is impressed to the following frame after a data signal is written in, voltage of a power supply for black status signals is switched, and a black display is ensured to it.

[0060]

[Embodiment of the Invention]Hereafter, the embodiment of a graphic display of this invention explains in detail.

<1st embodiment> drawing 1 is an outline lineblock diagram of the active matrix type liquid crystal display as a liquid crystal display in this embodiment. The liquid crystal display in this embodiment has the liquid crystal panel 11, two or more source drivers 12, and two or more gate drivers 13. Have the liquid crystal panel 11 and TFT substrate 14 and the counter substrate 15 on TFT substrate 14, The picture element electrode 16 arranged by matrix form and TFT17 by which the drain was connected to this picture element electrode 16, The source line S which was connected with the gate line G which was connected common to the gate in TFT17 of each line, and was arranged in parallel common to the sauce in TFT17 of each sequence, and was arranged in parallel is formed. The counterelectrode 18 which counters the picture element electrode 16 is formed in the counter substrate 15 which counters TFT substrate 14 with a prescribed interval. Although not illustrated, the liquid crystal is pinched between the picture element electrode 16 and the counterelectrode 18.

[0061]Here, the number of the above-mentioned gate lines G is 480, and the VGA (Video Graphics Array) panel whose source lines S are 640 (3 times when it is a colored presentation) books is used for the liquid crystal panel 11 in this embodiment. And the 480 gate lines G are divided into every 160 three groups, and are connected to the 1st gate driver 13a – the 3rd gate driver 13c for every group. Similarly, the source line S is divided into two or more groups, and is connected to the source driver 12 for every group.

[0062]The display control part 20 is outputted to the 1st source driver 12 with the video signal which has a clock signal generating means and into which the generated above-mentioned clock signal was inputted. It has a scan start signal generating means and a recognition signal creating means, and the scanning start signal and recognition signal which were generated are outputted to each gate driver 13 with a clock signal. An animation / still picture discrimination circuit 21 distinguishes a video subject's animation, or a still picture subject's still picture by monitoring the data of several points on a screen based on the video signal received from the display control part 20. And a discriminated result is returned to the display control part 20. If it does so, the display control part 20 will switch the change clock signal, recognition signal, and scanning start signal which are one of the above-mentioned clock signals to any the object for animations, and for still pictures they are based on the above-mentioned discriminated result.

[0063]The discriminated result from above-mentioned animation / still picture discrimination circuit 21 is outputted also to the reference supply 22 for signals, the power supply 24 for black signals, and the back light light control circuit 23. If it does so, the above-mentioned reference supply 22 for signals and the power supply 24 for black signals send out the reference voltage for data signals and the voltage for black signals according to the above-mentioned discriminated result to each source driver 12. The back light light control circuit 23 modulates the light of a back light (not shown) according to the above-mentioned discriminated result. The power supply 24 for black signals is a power supply used when generating the reset signal (black signal) explained in full detail behind.

[0064]Drawing 2 is an outline lineblock diagram of the above-mentioned source driver 12. However, it represents with the composition about the one source line S, and is displaying, and the thing of the same composition is provided about all the source lines S. The data for one picture element (1 horizontal line) is sampled by the sampling memory 31 from a video signal, and

this sampled data is stored in the holding memory 32. And a DA translation is carried out by DA converter 33 using the reference voltage for signals from the reference supply 22 for signals, and it is sent out to the changeover switch 34.

[0065]It is the clock signal which carried out dividing of the sampling clock signal supplied to the above-mentioned sampling memory 31, the holding memory 32, and DA converter 33 to the above-mentioned changeover switch 34, The above-mentioned change clock signal made into a cycle is inputted in all the source drivers 12 and 12 and the time of -- when the data for 1 horizontal line is sampled by the sampling memories 31 and 31 and --. And the changeover switch 34 is outputted to the source line S to which the level of the above-mentioned change clock signal chooses the data signal from DA converter 33, for example in "H", and corresponds. On the other hand, in "L", the black signal voltage from the power supply 24 for black signals is chosen, and it outputs to the corresponding source line S as the above-mentioned reset signal.

[0066]As shown the above-mentioned source driver 12 in drawing 3, even if it constitutes, it does not interfere. Namely, in the source driver 12 shown in drawing 2, although the changeover switch 34 is located in the latter part of DA converter 33, the changeover switch 35 is located in the preceding paragraph of the holding memory 38 in drawing 3. And in "H", the level of the above-mentioned change clock signal chooses the video signal from the sampling memory 37, for example, and sends out the changeover switch 35 to the holding memory 38. On the other hand, in "L", the black signal data from the black signal data generating part 36 is chosen, and it sends out to the holding memory 38. And a DA translation is carried out by DA converter 38 using the reference voltage for signals from the reference supply 22 for signals, and it is outputted to the corresponding source line S. In this way, while the data signal based on the above-mentioned video signal is outputted to the source line S in the first half of the time when the data for 1 horizontal line is sampled, in the second half, the above-mentioned reset signal based on the above-mentioned black signal data is outputted to the source line S.

[0067]Drawing 4 is an outline lineblock diagram of the above-mentioned gate driver 13. However, the composition of the gate driver 13 in this invention is not limited to this. The gate driver 13 of this embodiment has the shift register 41, and the output signal from each latch circuitry (not shown) which constitutes this shift register 41 is supplied to the output circuit 42. And the gate voltage of a level "H" or a level "L" is impressed to the gate line G by this output circuit 42, and the gate line G is chosen.

[0068]The above-mentioned shift register 41 shifts to the next latch circuitry the scanning start signal supplied to the 1st latch circuitry one by one based on the clock signal from the above-mentioned display control part 20, chooses the gate line G one by one, and goes. In that case, the above-mentioned scanning start signal is inputted also into the analog switch 43 which opens and closes the recognition signal from the display control part 20 as a control signal, When the level of the above-mentioned recognition signal is set to "H" and the analog switch 43 opens, the above-mentioned scanning start signal is supplied also to the 2nd - the 4th latch circuitry in the shift register 41.

[0069]The liquid crystal display which has the above-mentioned composition operates as follows, and performs a cine mode display. That is, drawing 5 is a timing chart of the selection signal outputted to the driving signal and each gate line G about the three gate drivers 13a, 13b, and 13c. The clock signal which was [semicircle term] late for the clock signal supplied to the 1st gate driver 13a located in an end is supplied to the 2nd gate driver 13b located in the center from the display control part 20 so that drawing 5 may show. The clock signal which was [semicircle term] late for the clock signal supplied to the 2nd gate driver 13b is supplied to the 3rd gate driver 13c located in the other end. The above-mentioned scanning start signal supplied to each gate drivers 13a-13c from the display control part 20 is a pulse signal with which one pulse exists in 1 clock eye and a 321 clock eye, shifts a phase to each gate driver 13 by 160 clocks, and is inputted into it. The "L" level for 320 clocks and the "H" level for 160 clocks exist, for example, and the above-mentioned recognition signal supplied to each gate drivers 13a-13c from the display control part 20 shifts a phase to each gate driver 13 by 160 clocks, and is inputted into it.

[0070]As a result, 1st gate line G_1 is first chosen by the 1st gate driver 13a of the above. As the

1st – the 4th gate line G, i.e., the whole, the 161st – 164th gate line G_{161} – G_{164} are chosen as such the back by the 2nd gate driver 13b. Next, after 2nd gate line G_2 is chosen by the 1st gate driver 13a, the 162nd – 165th gate line G_{162} (the 2nd – the 5th) – G_{165} are chosen by the 2nd gate driver 13b. Henceforth, selection is performed one by one by the two gate drivers 13a and 13b in a similar manner, and 320th gate line G_{320} (the 160th) is soon chosen by the 2nd gate driver 13b.

[0071]When it does so, with the 2nd gate driver 13b of the above next The 1st gate line G. That is, after 161st gate line G_{161} is chosen as the whole, as the 1st – the 4th gate line G, i.e., the whole, the 321st – 324th gate driver G_{321} – G_{324} are chosen by the 3rd gate driver 13c. Next, after 162nd gate line G_{162} (the 2nd) is chosen by the 2nd gate driver 13b, the 322nd – 325th gate line G_{322} (the 2nd – the 5th) – G_{325} are chosen by the 3rd gate driver 13c. Henceforth, selection is performed one by one by the two gate drivers 13b and 13c in a similar manner, and the 480th gate line (the 160th) G480 is soon chosen by the 3rd gate driver 13c.

[0072]When it does so next, with the 3rd gate driver 13c of the above The 1st gate line G. That is, after 321st gate line G_{161} is chosen as the whole, the 1st – 4th gate line G_1 – G_4 are again chosen by the 1st gate driver 13a. And if 160th gate line G_{160} is chosen by the 1st gate driver 13a after 480th gate line G_{480} (the 160th) is chosen by the 3rd gate driver 13c, the scan of one frame will be completed.

[0073]The timing chart shown in drawing 5 is a case where the recognition signal with which the "H" level for 160 clocks exists is given to each gate drivers 13b–13a one by one as mentioned above, Since the analog switch 43 of the gate driver 13 whose level of a recognition signal is "H" serves as one, the four continuous gate lines G are chosen in the gate driver 13. On the other hand, when all the levels give the recognition signal which is "L" to each gate driver 13. the two gate drivers 13 which adjoin as shown in drawing 6 since the analog switch 43 of all the gate drivers 13 is OFF ‐‐ alternation ‐‐ and the gate line G per will be chosen, shifting.

[0074]Hereafter, the picture displaying operation by the liquid crystal display in this embodiment is explained concretely. The data signal and the above‐mentioned reset signal with which the sequence of the source driver 12 was stored in the holding memory 32 as mentioned above are outputted by turns. In that case, the pulse width of the change clock inputted into the changeover switch 34 is set up so that the width of the output time of both the signals that can be set may become equal mutually. The width of the above‐mentioned output time in this embodiment is 17 microseconds of about 16.7 ms (one frame time)/480 / 2** abbreviation.

[0075]A clock signal and a scanning start signal which were mentioned above, and the recognition signal in which all the levels are "L" shall be inputted into the gate driver 13 which chooses the above‐mentioned horizontal line. If it does so, as shown in drawing 6, after the n‐th gate line G is chosen, the gate line G of eye watch will be chosen (n+160). After the gate line G of eye watch (n+1) is chosen, the gate line G of eye watch is chosen (n+161). However, (n+m) counts from a head line following a last line, in being more than a line number, and a selection line is called for. The width of the selection time of each gate line G is about 17 microseconds as well as the width of the output time of the signal to the source line S. In that case, so that the gate line G of eye watch (n+160) may be chosen, when the n‐th gate line G is chosen when the source driver 12 outputs the above‐mentioned data signal, and the source driver 12 outputs the above‐mentioned reset signal, The timing of the above‐mentioned change clock and a scanning start signal is set up.

[0076]Like ****, giving the above‐mentioned reset signal to the gate line G of the 160 beyond of the gate line G which outputted the above‐mentioned data signal (m= 160) is based on the following reason. That is, the response time when the transmissivity of a liquid crystal changes from 100% to 10% is about 4 ms. And when a reset signal is impressed to the picture element electrode of a certain picture element connected to a certain gate line G, by the time a data signal is impressed next, it is necessary to be a black display in general. Therefore, the following

relation is materialized. ·

fxm/N> 4 ms, however f:one-frame-time (16.7 ms) N: It is necessary to be the total number (480) of gate lines, therefore m> 115.

[0077]Here, in this embodiment, the gate driver 13 connected to the 160 gate lines G is arranged to three-piece straight line shape, and 480 are scanned. Therefore, if referred to as m= 160, from the next gate driver 13 of the gate driver 13 which is outputting the current data signal. By very easy control of outputting a reset signal to the gate line G of the same number as the number of the gate line G to which the data signal is outputted, the conditions of m> 115 are clearable.

[0078]About the indication results by such picture displaying operation, it is as follows as compared with the indication results by the conventional liquid crystal display. Here, the stabilimentum 52 to which the picture used for explanation has the width for 3 picture elements in the center of the black background 51 as shown in drawing 7 is arranged in the lengthwise direction. And this stabilimentum 52 presupposes that it is the video which moves at a time one picture element, and goes for every frame like an arrow (A).

[0079]First, it attaches and states to the image display method by the conventional liquid crystal display. The image display sequence of 1 frame period by the conventional liquid crystal display is shown in drawing 8. A part for 1 horizontal line of the video signal sent is sampled by the sampling memory 2 of the source driver 1, and is once stored in the holding memory 3. [one] [after another] And the data signal for 1 horizontal line read from the holding memory 3 is written in the picture element line which constitutes 1 horizontal line selected with the gate driver. The data signal of 2 horizontal-line eye is sampled sampling memory 2, and, simultaneously with it, the contents of the holding memory 3 are rewritten. This is repeated by 480 horizontal lines and the data signal writing for one frame is completed.

[0080]Normally white type TN (it is twisted and nematic) mode is used for a liquid crystal. The time when the time when transmissivity reaches to -> [0% of] 90% is about 20 ms, and the characteristic reaches to -> [100% of] 10% is about 4 ms.

[0081]When the above video is displayed by the image display sequence of the conventional liquid crystal display, as shown in drawing 9, an afterimage (blot of a picture) clear in the picture element sequence 53 which changed from the stabilimentum 52 to the background 51 is seen. This cause is explained as follows. That is, drawing 10 shows the transmittance change for every [in the arbitrary picture elements 54 which adjoin the stabilimentum 52 in the direction-of-movement front of the stabilimentum 52 in drawing 7] frame. Ideally, in the 1st frame, it is a black display (transmissivity <10%), the 2nd frame – four frames are white displays (transmissivity > 90%), and this transmittance change should return to the black display again by the 5th frame. However, as mentioned above, time until transmissivity reaches to 90% from 0% is about 20 ms, and time until it reaches to 10% from 100% has the characteristic of the liquid crystal of about 4 ms. Therefore, at the 1st frame, when a white signal is written in the picture element 54 which was a black display by the 2nd frame, the liquid crystal of the picture element 54 will be abbreviated-completed by the 3rd frame, without the ability to complete a response in frame time. Therefore, in the 4th frame, it becomes an original white display. And although a black signal is written in in the 5th frame, since the time when transmissivity reaches to 10% from 100% is about 4 ms, as the picture element sequence 53 shows, some light leakage is observed. Therefore, in the conventional image display sequence, the width of the stabilimentum 52 does not look clear to a part for 3 picture elements.

[0082]Next, it attaches and explains to the picture displaying operation in the liquid crystal display of this embodiment. In this liquid crystal display, the reset signal of the voltage which can attain a black display within 1 frame period is written in between the data signal writing of each horizontal line. The image display sequence in the liquid crystal display of this embodiment is shown in drawing 11. The concrete contents of the writing in drawing 11 (a) and the reset period are shown in drawing 11 (b). As shown in drawing 11, in this embodiment, the writing of a data signal and the writing of a reset signal are performed by turns 1/2 cycle of a sampling period. In that case, the writing of a reset signal is performed to the horizontal line of the 160 beyond of a data signal write-in horizontal line.

[0083]In this embodiment, by adopting such an image display sequence, as shown in drawing 12, an afterimage (blot of a picture) is not checked by the picture element sequence 63 which changed from the stabilimentum 62 to the background 61. This reason can be explained as follows. Drawing 13 shows the transmittance change for every [in the arbitrary picture elements 64 (equivalent to the picture element 54 in drawing 7) which adjoin the stabilimentum 62 in the direction-of-movement front of the stabilimentum 62 in drawing 12] frame. This picture element 64 is a black display in the 1st frame. And although a white signal is written in in the 2nd frame, a black signal is written in by a at a certain time (at the time of being the next in which the white signal was written to the horizontal line behind [that the picture element 64 concerned belongs / 160] a horizontal line) within frame time. And the voltage of this black signal is the voltage which can attain a black display within 1 frame period as mentioned above, and a is set [above-mentioned] up at the time so that transmissivity may reach to 10% within the residual time of the 2nd frame. Therefore, it can return to the black display by the following frame.
[0084]This is the same also in the 3rd and the 4th frame. therefore, the 2- in the 4th frame, a white signal will be written in the picture element 64 only the same time, and the maximum transmittances in each frame become the same. as a result, the 2- the same luminosity can be displayed in the 4th frame. In the 5th frame, since the black signal is already written in after a at the time of the 4th frame, it is at the start time and transmissivity presents 10% or less, and light leakage is not observed.
[0085]Reduction of the afterimage by the image display sequence of this embodiment can be explained also for the following reasons. In order to explain simply, the response time of a liquid crystal explains an infinitesimal case. The stabilimentum of the above 3 picture-element width is the video which moves at a time to one way one picture element for every frame, and the picture used for explanation shows drawing 14 the situation of movement of the stabilimentum in arbitrary horizontal lines. The case of the conventional image display sequence is shown for the response waveform of the transmissivity in infinitesimal response time in drawing 15, and the case of the image display sequence of this embodiment is shown in drawing 16.
[0086]Drawing 17 shows the situation of movement of the stabilimentum in the arbitrary horizontal lines by the conventional image display sequence. Since the data signal written in arbitrary picture elements is held during a frame period, stabilimentum has stopped throughout [one frame term]. And if it enters at the next frame period, it would move by 1 picture element and will have stopped throughout [one frame term] again. An above-mentioned thing is repeated henceforth. And when human being observes a motion of above-mentioned stabilimentum, stabilimentum recognizes as an animation which moves smoothly. In other words, it cannot recognize that stabilimentum is standing it still for every frame. Therefore, into drawing 17, as the arrow (B) and (C) of a dashed line shows, human being's viewpoint will be moved at a fixed speed.
[0087]Therefore, in human being's retina, as shown in drawing 18, the luminosity which considered the motion is sensed. As a result, rather than the image of actual stabilimentum based on a data signal, it will be visible to the form in which both edge became blunt, and the afterimage which spread will be sensed. Since it will sense that human being's eyes are moving smoothly although stabilimentum is standing it still for every frame if it puts in another way, In the first half of one frame, as the sign "b" shows, there is stabilimentum ahead of human being's look, and since human being's look has passed stabilimentum in the second half of one frame, as the sign "c" shows, stabilimentum will be after a look. and -- human being's retina top -- a stabilimentum image -- "-- since the image by which existing /-less" was equalized is projected, the stabilimentum image on which edge became blunt and spread is in sight. Like the above, a blot of an animation is certainly sensed by the conventional image display sequence.
[0088]Next, in the case of the image display sequence in the liquid crystal display of this embodiment, it attaches and explains. Drawing 19 shows the situation of movement of the stabilimentum in the arbitrary horizontal lines by the image display sequence of this embodiment. In this image display sequence, since "m" which is a difference of the write-in line number of a reset signal and the write-in line number of a data signal is set as "160", a data signal is held only two thirds in the first half of throughout [one frame term], and in the second half, one third, a

black signal is held and it becomes a black display. That is, only two thirds, stabilimentum will stop and stabilimentum will disappear by one third in the second half in the first half of throughout [one frame term]. Therefore, the display period of stabilimentum can be cut down to two thirds of 1 frame periods, and the period after the look shown with the period which has the stabilimentum shown with a sign "b" ahead of human being's look, and a sign "c" can be shortened so that clearly from comparison with drawing 19 and drawing 17. Therefore, as shown in drawing 20 as a result, a blot of the edge of a stabilimentum image can be reduced.

[0089]In above-mentioned explanation, since it was easy, it assumed that the response time of a liquid crystal was the infinitesimal, but if a black display is performed for every frame, even if the response time of a liquid crystal will not be the infinitesimal, it is clear from above-mentioned explanation that the same effect is acquired.

[0090]By the way, in [so that comparison with drawing 15 and drawing 16 may show] this embodiment, Since the process in which it becomes arbitrary transmissivity from black transmissivity, and the process in which it becomes black transmissivity from arbitrary transmissivity are included for every frame about a display picture element, transmissivity becomes low substantially rather than the case where the conventional image display sequence is applied. Therefore, in order to obtain luminosity equivalent to the case where the conventional image display sequence is applied, it is necessary to make the luminosity of a back light increase.

[0091]Then, in consideration of adopting this liquid crystal display as a portable device, several [on a screen] were monitored and the picture displayed now has formed the animation / still picture discrimination circuit 21 which distinguishes automatically an animation subject's picture, or a still picture subject's picture. And when it is distinguished by the back light light control circuit 23 that it is video, the luminosity of a back light is made to increase according to the discriminated result of an animation / still picture discrimination circuit 21. When it is distinguished that it is a still picture, the luminosity of the above-mentioned back light is reduced. By carrying out like this, power consumption can be reduced as compared with the case where it always fixes to the luminosity of the back light aligned with video, and the portable liquid crystal display excellent in animation display grace can be obtained by the necessary minimum power consumption rise.

[0092]Instead of forming above-mentioned animation / still picture discrimination circuit 21, the switch which chooses the image display sequence of this embodiment and the conventional image display sequence is formed, and even if a user makes which image display sequence selectable, it does not interfere. And when the above-mentioned switch is switched to the image display sequence side of this embodiment, the luminosity of a back light is made to increase by the back light light control circuit 23 synchronously. Also in this case, the liquid crystal display excellent in animation display grace can be obtained by the minimum power consumption rise.

[0093]Since the process in which it becomes arbitrary transmissivity from black transmissivity for every frame in this embodiment like ****, and the process in which it becomes black transmissivity from arbitrary transmissivity are included, as shown in drawing 21, it differs from the case where the relation between write voltage and transmissivity is the conventional image display sequence. As shown in drawing 22, aging of the transmissivity in each gradation also differs by the image display sequence of this embodiment, and the conventional image display sequence.

[0094]So, when the image display sequence in this embodiment is adopted in consideration of these results. Based on the discriminated result of an animation / still picture discrimination circuit 21, by the reference supply 22 for signals. As compared with the case where the conventional image display sequence is adopted, good gradation balance can be obtained by readjusting amplitude for the write voltage in each gradation greatly on the basis of a black display.

[0095]As mentioned above, in this embodiment, the VGA panel is used as the liquid crystal panel 11. And the changeover switch 34 which changes both the signals of the data signal stored in the holding memory 32 and the above-mentioned reset signal based on black signal voltage to the source line S, and outputs them during 1 horizontal-line sampling period is formed in the

source driver 12. The 480 gate lines G are divided into every 160 three groups, and each group's gate line G is connected to the 1st gate driver 13a – the 3rd gate driver 13c.

[0096]And the clock signal which was behind [the 1st gate driver 13a – the 3rd gate driver 13c] in the half cycle [every] phase one by one from the above-mentioned display control part 20 is supplied. He shifts 160 clocks of phases at a time to the 1st gate driver 13a – the 3rd gate driver 13c, and is trying to input into them the scanning start signal with which one pulse exists in 1 clock eye and a 321 clock eye from the display control part 20.

[0097]Therefore, when the above-mentioned source driver 12 outputs the above-mentioned data signal. So that the gate line G of eye watch (n+160) may be chosen, when the gate driver 13 chooses the n-th gate line G, and the source driver 12 outputs the above-mentioned reset signal, By setting up the timing of the above-mentioned change clock and a scanning start signal, as shown in drawing 13, a reset signal will be written in the picture element in which the data signal was written in the second half of the frame concerned one third.

[0098]If the voltage (getting it blocked voltage of the power supply 24 for black signals) of the above-mentioned reset signal is set as the voltage which can attain a black display within 1 frame period and is set in that case, it can return to a black display by the following frame. Namely, in writing in a black signal with the following frame to the picture element in which the white signal was written according to this embodiment. Since the black signal is already written in in one third in the second half of a previous frame, transmissivity presents 10% or less at the start time of the frame concerned, and light leakage is not observed.

[0099]The edge part of the image in video repeats movement and a stop in each frame. In that case, since the human being cannot recognize the stop of the above-mentioned edge part visually, the above-mentioned edge part seems to move smoothly. And in this embodiment, in one third, a reset (black) signal is written in in the second half of a frame to the picture element in which the data signal was written, and an image disappears. However, since the human being cannot recognize that the image disappeared visually, the period which has an edge part of the above-mentioned image ahead of human being's look, and the period in behind become short, and as shown in drawing 20 as a result, he can reduce a blot of the edge part of video.

[0100]In this embodiment, the picture currently displayed has formed the animation / still picture discrimination circuit 21 which judges automatically an animation subject's picture, or a still picture subject's picture. And when it is distinguished by an animation / still picture discrimination circuit 21 that it is video, he is trying to make the luminosity of a back light increase by the back light light control circuit 23. Therefore, at the time of a cine mode display, decline in the transmissivity produced in order to write a reset signal in back 1 / 3 of one frame can be prevented by necessary minimum increased power consumption.

[0101]That is, according to this embodiment, improvement in animation display grace can be aimed at by necessary minimum increased power consumption by performing the minimum improvement to the liquid crystal display provided with the conventional VGA panel.

[0102]Although the above-mentioned explanation of operation is carrying out the case of the cine mode display to the example, it cannot be overemphasized that a still picture can also be displayed. When displaying a still picture, from the display control part 20, the change clock signal for the still pictures of ″H″ in all the levels is outputted to the source driver 12, and only a data signal is outputted over the whole sampling period of 1 horizontal line. While the scanning start signal for still pictures with which one pulse exists shifts a phase to each gate drivers 13a-13c by 160 clocks and is inputted into them, the recognition signal for the still pictures of ″L″ in a level is outputted to each gate driver 13. In this way, like the conventional liquid crystal display, choosing the 480 gate lines G from an end one by one, a data signal is outputted to all the source lines S, and a picture is displayed.

[0103]In above-mentioned explanation, although the relation in particular of the voltage of the above-mentioned reference supply 22 for signals and the power supply 24 for black signals is not described, display quality can be further improved by setting up as follows. Namely, if reference voltage for the black images from the reference supply 22 for signals (black reference voltage) is set to Vd and voltage of the power supply 24 for black signals is set to Vr, In the case of straight polarity, both voltage is set up to the potential level of the counterelectrode 18 fill the

relation of Vd>Vr at the time of.Vd<Vr and a normally black at the time of a normally white. On the other hand, in the case of negative polarity, both voltage is set up fill the relation of Vd<Vr at the time of Vd>Vr and a normally black at the time of a normally white. By carrying out like this, shortage of the feed time of a black status signal can be compensated, and improvement in display quality can be aimed at more.

[0104]Usually, in order to supply a signal level certainly, the feed time for 20.5 microseconds is required for TFT(switching element)17 at the shortest. When one frame time drives the above-mentioned VGA panel in 16.7 ms (= 16700 microseconds) as mentioned above in one side, That is, in driving the 480 gate lines G at 60 Hz, one horizontal period is set to 10^6mus/60 (Hz) / 480 (book)= 34.7 microseconds. Then, data signal feed time and black signal feed time are set to data signal feed time =20.8microsecond black signal feed time =34.7microsecond-20.8microsecond=13.9microsecond. The timing chart of each driving signal and a selection signal is shown in drawing 23, and an image display sequence is shown in drawing 24.

[0105]Thus, by setting up each signal supply time, the data from the source drivers 13a-13c can be certainly supplied to the picture element electrode 16. If black signal feed time becomes short, it will be thought that supply (charge to picture element capacity) of sufficient black signal is not performed. However, if a voltage-transmittance curve is looked at in the case of many liquid crystal display elements, near the black display, it is that which shows an insensible transmittance change to voltage (transmissivity is saturated near the black display in 0), and even if supply of a black signal runs short somewhat, sufficient effect can be acquired. This embodiment is defined as one frame time being time required in order to display the picture of the whole screen of a liquid crystal display regardless of a video signal system. For example, in the case of an interlace video signal system, generally, one frame time comprises the two fields and the whole screen of a liquid crystal display is displayed by 1 field time which hits one half of frame time.In this case, in this embodiment, it is considered that the above-mentioned 1 field time is one frame time. In the case of other video signal systems, it is the same. This presupposes that it is the same also in each future embodiment.

[0106]The outline composition of the liquid crystal display in the <2nd embodiment> book embodiment is the same as the active-matrix type liquid crystal display in a 1st embodiment shown in drawing 1. However, the liquid crystal display in this embodiment uses the S-XGA (super XGA) panel for the liquid crystal display section. The number of picture elements is 1280 (case of colored presentation 3 times)x1024, uses the number of the gate lines G, and differs from the VGA panel in a 1st embodiment about 2 times. Therefore, output a data signal and a reset signal by turns with the same output time width like the case of a 1st embodiment, then the selection time of 1 horizontal line is 8.1 microseconds of about 16.7 ms (one frame time)/1024 / 2** abbreviation. Therefore, each signal writing (that is, charge) cannot fully be performed to a picture element.

[0107]If each above-mentioned picture element electrode is used from the capability of the TFT element which switches connection with the source line S, at least 12.0 microseconds is required for the selection time of 1 horizontal line. Then, the change clock supplied to the changeover switch 34 in the source driver 12 in this embodiment, It sets up assign 12.0 microseconds in the maximum selection time of 1 horizontal line which is 16.7 ms (one frame time)/1024 ** about 16.3 microseconds to data signal writing time, and assign the remaining 4.3 microseconds to reset signal write time.

[0108]However, it is impossible to write in a reset signal enough in 1 time of a selection period in such reset signal write time. Then, in this embodiment, as shown in drawing 25 and drawing 26, It has connected with four gate drivers (henceforth the 1st gate driver 13a − the 4th gate driver 13d) which divide the 1024 gate lines G into every 256 four groups, and are different for every group. However, the basic constitution of each gate driver 13 is the same as the composition shown in drawing 4. And on the occasion of image display, a phase is shifted to each gate driver 13 by 256 clocks, and the recognition signal with which the "L" level for 768 clocks and the "H" level for 256 clocks exist in each gate drivers 13a-13d from the display control part 20 is inputted into it. A phase is shifted to each gate driver 13 by 256 clocks, and the scanning start signal with which one pulse exists in 1 clock eye and a 769 clock eye is inputted into it.

[0109]As a result, since the analog switch 43 of the gate driver 13 whose level of the above-mentioned recognition signal is "H" serves as one, In the gate driver 13, the four continuous gate lines G will be chosen, and the one gate line G and the four gate lines G will be chosen by turns by the two adjoining gate drivers 13, shifting.

[0110]The image display sequence in the liquid crystal display of this embodiment is as being shown in drawing 27. The concrete contents of the writing in drawing 27 (a) and the reset period are shown in drawing 27 (b). As shown in drawing 27, in this embodiment, the writing of a data signal and the writing of a reset signal are performed by turns with above different time width. In that case, the writing of a reset signal is simultaneously performed to four horizontal lines which continued from the 256 beyond of the data signal write-in horizontal line based on the above recognition signals and scanning start signals from the display control part 20.

[0111]It can continue 4 times into one frame, a reset signal can be written in each horizontal line, and a black display can be made to fully perform reset signal write time also as 4.3 microseconds by carrying out like this, as shown in drawing 28. That is, according to this embodiment, a blot and afterimage of animation display can be reduced in the active matrix type liquid crystal display using the S-XGA panel as the liquid crystal panel 11.

[0112]In this embodiment, giving the above-mentioned reset signal to the gate line G of the 256 beyond of the gate line G which outputted the above-mentioned data signal (m= 256) is based on the following reason like ****. That is, as mentioned above, the response time when the transmissivity of a liquid crystal changes from 100% to 10% is about 4 ms. And when a reset signal is impressed to the picture element electrode of a certain picture element connected to a certain gate line G, by the time a data signal is impressed next, it is necessary to be a black display in general. Therefore, the following relation is materialized.

fxm/N> 4 ms, however f:one-frame-time (16.7 ms) N: It is necessary to be the total number (1024) of gate lines, therefore m> 246.

[0113]Here, in this embodiment, the gate driver 13 connected to the 256 gate lines G is arranged to four-piece straight line shape, and 1024 are scanned. Therefore, if referred to as m= 256, from the next gate driver 13 of the gate driver 13 which is outputting the current data signal. By very easy control of outputting a reset signal to the gate line G of the same number as the number of the gate line G to which the data signal is outputted, the conditions of m> 246 are clearable.

[0114]Also in the case of this embodiment, a display image judges automatically an animation subject's picture, or a still picture subject's picture by the animation / still picture discrimination circuit 21, If the luminosity of a back light is made to increase by the back light light control circuit 23 when it is video, the portable liquid crystal display excellent in animation display grace can be obtained by necessary minimum power consumption rise.

[0115]In above-mentioned explanation, the case where a reset signal is written in the gate line G of k book from a flat knot (n+m) in succession [after writing a data signal in the gate line G of n flat knot] is mentioned as the example. However, even if it divides into p groups the gate line G of K book with which the above-mentioned reset signal is written in every m book, it does not interfere. In that case, a reset signal will be simultaneously written in k (= K/p book) continued for every group.

[0116]An example of the timing chart of each driving signal and a selection signal is shown in drawing 29 (the gate driver 13d is omitted). The image display sequence of 1 frame period is shown in drawing 30. Drawing 29 is an example in m= 256, p= 2, and k= 1.

[0117]As mentioned above, the following effects can be done so by distributing in p groups every m book, and writing a reset signal in the gate line G. That is, a liquid crystal begins to answer to a black display by the write-in start of a reset signal, and has the characteristic that the dielectric constant changes gradually and goes (for the permittivity anisotropy of a liquid crystal). Therefore, even if it impresses predetermined reset voltage to a liquid crystal, the voltage actually impressed to the liquid crystal by the dielectric constant change will be changed.

[0118]However, if its attention is paid to one certain horizontal line by distributing p groups every m book and supplying a reset signal to the gate line G of k book, whenever it is scanned this [m], a reset signal will be supplied once. That is, a liquid crystal answers to some extent with the 1st reset signal, and the dielectric constant changes. And supply of the 2nd reset signal

will be performed after m this scan to the liquid crystal from which the above-mentioned dielectric constant changed. Therefore, the more positive black display can be obtained by repeating this operation p times.

[0119]In other words, the signal supply to a liquid crystal element is impression operation (namely, charging operation) to each picture element capacity of a signal level. Therefore, the dielectric constant will change with the contents (oriented state) of the display, and a liquid crystal will differ in the amount of charging charge according to the last display information. Therefore, even if it supplies the same signal as the same picture element, it will be a display which is different when front display information differed.

[0120]However, by setting only the time when the gate line G of m book is scanned as mentioned above, and writing in a reset signal repeatedly p times, the problem of an above-mentioned dielectric constant change can be solved, and the still better black display can be obtained.

[0121]In the liquid crystal display in a 1st embodiment of <a 3rd embodiment>, since the speed of response of a liquid crystal will become slow if it is used under low temperature, before the black display by a reset signal is completed, the data signal of a next frame will be written in, and there is a problem said that the amount of blots of an animation increases. Although this problem is solvable applying a 2nd embodiment, i.e., by switching the recognition signal from the display control part 20, It is cancelable also by controlling response time until it becomes black transmissivity from the transmissivity according to the above-mentioned data signal to be settled within a frame period. Hereafter, the control method of response time until it becomes black transmissivity from the arbitrary transmissivity according to the above-mentioned data signal is explained.

[0122]Control methods of the above-mentioned response time include the following methods.

(1) Increase ″m″ which is a difference of the write-in line number of a reset signal, and the write-in line number of a data signal with the fall of environmental temperature. By this, reset signal write time is lengthened, the response time at the time of reset-signal writing can be enough settled within a frame period, and the speed-of-response fall of the liquid crystal can be compensated.

[0123](2) Enlarge voltage for black signals from the power supply 24 for black signals (getting it blocked voltage of a reset signal) with the fall of environmental temperature. By this, reset-signal drawing speed is made quick, the response time at the time of reset-signal writing can be enough settled within a frame period, and the speed-of-response fall of the liquid crystal can be compensated.

[0124]Although many things are considered as a changing method of ″m″ in the above (1), it carries out as follows, for example. That is, the shift register 41 of each gate driver 13 currently divided into plurality is connected in series. And an analog switch is connected to each of the input terminal of the latch circuitry of the m-th - (m+J) eye watch among the latch circuitry which constitutes all the shift registers 41, It passes any of the analog switch of this (J+1) individual they are, and the input of the above-mentioned scanning start signal is enabled also at the input terminal of the latch circuitry of the m-th - (m+J) eye watch. The one [the control circuit for the above-mentioned analog switches is provided, and / with this control circuit / the analog switch of eye watch (m+j (j<=J))] according to the temperature fall of environmental temperature.

[0125]In this embodiment, even if it carries out only either one of the above-mentioned control method (1) or (2), the increase in the amount of blots of the video due to the fall of the speed of response of a liquid crystal is avoidable.

[0126]In a 2nd embodiment of the above, although the case where the writing of the above-mentioned reset signal was simultaneously performed to four horizontal lines was explained to the example, this invention is not limited to four horizontal lines. The writing of a reset signal is not limited to the horizontal line of a fixed number, and even if it enables change of the write-in number of a reset signal, it does not interfere. What is necessary is just to perform various changing methods of the write-in number of the above-mentioned reset signal in that case as follows, for example, although it thinks.

[0127]Namely, an analog switch is connected to each of the input terminal of the 2nd - the Kth latch circuitry in each gate driver 13 in drawing 4, It passes any of the analog switch of this (K-1) individual they are, and supply of the scanning start signal from the analog switch 43 also to the input terminal of the 2nd - the Kth latch circuitry is enabled. The one [the control circuit for the above-mentioned analog switches is provided, and / with this control circuit / the analog switch of the 2nd - eye k (k<=K) watch] according to k signal from the outside. k signal is a signal which specifies the write-in number of a reset signal.

[0128]In each above-mentioned embodiment, although the case where this invention is applied to an active matrix type liquid crystal display is explained to an example, it cannot be overemphasized that it is applicable also to a duty type liquid crystal display.

[0129]

[Effect of the Invention]As mentioned above, so that clearly the liquid crystal display method of the 1st invention, Supply a selection signal to the column line of n flat knot, and supply a data signal to a line and the picture based on the above-mentioned data signal is displayed on the picture element of a selection row line, Next, supply the above-mentioned selection signal to the column line of a flat knot (n+m), and supply a black status signal to the above-mentioned line, and a black image is displayed on the picture element of a selection row line, Since the display action of the picture based on the above-mentioned data signal and the display action of a black image are repeated shifting the above-mentioned selection row line one by one, The state where the black status signal was written in is held until it writes in the above-mentioned data signal, and it supplies a black status signal and an image data signal is newly written in the following frame to all the picture elements, after the predetermined time according to m passes further, and a black image can be displayed. Therefore, when changing into a black display the picture element which is performing the white display with the following frame, before the following data signal is written in, the black image will already be displayed, and the optical leakage of a back light can be prevented.

[0130]Since the picture element which shows the image will serve as a black display as mentioned above by the time a data signal is impressed next, and an image disappears, the period which has the edge of the image in an animation ahead of human being's look, and the period in behind can be shortened. Therefore, a blot of the edge of the above-mentioned image can be reduced.

[0131]That is, according to this invention, animation display grace can be improved by the minimum change called the supply of a black status signal and the change of the selection method of the above-mentioned column line to the above-mentioned line.

[0132]The liquid crystal display method of the 2nd invention supplies a selection signal to the column line of n flat knot, and supplies a data signal to a line and displays the picture based on the above-mentioned data signal on the picture element of a selection row line, Next, supply the above-mentioned selection signal to several different column lines from the above-mentioned n flat knot simultaneously, and supply a black status signal to the above-mentioned line, and a black image is displayed on the picture element of a selection row line, Since the display action of the picture based on the above-mentioned data signal and the display action of a black image are repeated shifting the above-mentioned selection row line one by one, by the time a data signal is impressed next, a multiple-times black status signal can be supplied. Therefore, a black display can be ensured by supplying a black status signal [the case where it is the time when the above-mentioned black status signal feed time is insufficient for a black image display /, two or more times].

[0133]Therefore, according to this invention, the picture element density of a display panel is high density, and since there are many column lines, even when black status signal feed time cannot be taken enough, the minimum change can perform high-definition animation display in which a blot of the light in optical leakage or image edge part of a back light does not occur.

[0134]If two or more above-mentioned column lines are made into the column line of a flat knot (alpha($_{n+alpha-m}$) = 1, 2, --, p), the liquid crystal display method of an invention of the above 2nd can repeat a black display for every scan of m book about one certain horizontal line, and can be performed. Therefore, change of the dielectric constant of the picture element capacity by the

display information in the last frame can be eliminated, and a still more nearly high-definition display can be performed.

[0135]The liquid crystal display method of an invention of the above 2nd can perform a black display repeatedly about one certain horizontal line k times for every scan of m book, if two or more above-mentioned column lines are made into the column line from a flat knot (n+alpha-m) (n+alpha-m+k-1) (alpha= 1, 2, --, p) to a flat knot. Therefore, the influence of the display information in the last frame can be lost further.

[0136]The liquid crystal display method of the 1st above-mentioned invention or the 2nd invention can switch supply of the above-mentioned data signal, and supply of the above-mentioned black status signal by very easy switching control processing, if feed time of the above-mentioned data signal and feed time of the above-mentioned black status signal are made equal.

[0137]If feed time of the above-mentioned data signal is made longer than the feed time of the above-mentioned black status signal, the picture element density of a display panel is high density, and since the liquid crystal display method of the 1st above-mentioned invention or the 2nd invention has many column lines, also when data signal feed time cannot fully be taken, it can cope with it.

[0138]If the value of the above-mentioned m is set up fill the relation of a following formula, as for the liquid crystal display method of the 1st above-mentioned invention or the 2nd invention, the feed time of the above-mentioned black status signal in 1 frame period can be set up more than the response time of the liquid crystal in the case of switching a white display to a black display. Therefore, even if it is a picture element as which a white image is displayed based on the above-mentioned data signal, a black display can be ensured by the time a data signal is impressed next.

$fxm/N > t$, however N:several f column-line:one-frame-time t: Response time of the liquid crystal at the time of switching a white display to a black display [0139]If the value of the above-mentioned k is set up fill the relation of a following formula, as for the liquid crystal display method of the 1st above-mentioned invention or the 2nd invention, the feed time of the above-mentioned black status signal in 1 frame period can be set up beyond the shortest time which can switch a white display to a black display by k times supply of a black status signal. Therefore, since the feed time of the above-mentioned black status signal is insufficient, when repeating black status signal supply k times and supplying it, even if it is a picture element as which a white image is displayed based on the above-mentioned data signal, a black display can be ensured by the time a data signal is impressed next.

$Txk >= T_0$, however 1 time of feed-time T_0 of T:black status signal: Shortest time of the black status signal which can switch a white display to a black display thoroughly [0140]The liquid crystal display method of the 1st above-mentioned invention or the 2nd invention, A black display can be ensured, even when the time of supply of the above-mentioned black status signal is insufficient and sufficient black display cannot be performed, if the voltage Vd in case the above-mentioned data signal is a data signal for a black display, and the voltage Vr of the above-mentioned black status signal are set up fill the following relation. To the potential level of a counterelectrode, in the case of straight polarity, Vd<Vr is received at the time of a normally white, and it receives at the potential level of a Vd>Vr counterelectrode at the time of a normally black, and in the case of negative polarity, it is Vd>Vr at the time of a normally white, and Vd<Vr at the time of a normally black. [0141]With the control signal from a display control part, when the changeover switch of a line driver has chosen the data signal, the liquid crystal display of the 3rd invention, While supplying a selection signal to the column line of n flat knot, when the above-mentioned changeover switch has chosen the black status signal, a column line driver, Since the above-mentioned column line driver supplies a selection signal to the column line of a flat knot (n+m), The state where the above-mentioned black status signal was written in is held until it writes in a data signal, and it supplies a black status signal and an image data signal is newly written in the following frame to all the picture elements, after the predetermined time according to m passes further, and a black image can be displayed. Therefore, when changing into a black display the picture element which is performing the white display with the following

frame, before the following data signal is written in, the black image will already be displayed, and the optical leakage of a back light can be prevented.

[0142]That is, according to this invention, animation display grace can be improved by the minimum change of providing a changeover switch in the above-mentioned line driver, and changing the control signal from the above-mentioned display control part into it.

[0143]With the control signal from a display control part, when the changeover switch of a line driver has chosen the data signal, the liquid crystal display of the 4th invention, While supplying a selection signal to the column line of n flat knot, when the above-mentioned changeover switch has chosen the black status signal, a column line driver, Also in the case of time which cannot perform black image display with the above-mentioned black status signal feed time sufficient by just one black status signal supply, since the above-mentioned column line driver supplies a selection signal to two or more different column lines from the above-mentioned n flat knot, black status signal supply can be repeated two or more times, and a black display can be ensured. Therefore, since there are [high density] many column lines, even when picture element density of a display panel cannot take black status signal feed time enough, high-definition animation display to which the optical leakage of a back light does not take place can be performed.

[0144]The liquid crystal display of the 3rd above-mentioned invention or the 4th invention, If constituted from L partial column line drivers who divide the above-mentioned column line into L blocks for every m book, and supply a selection signal to the column line of each block of the above-mentioned column line driver, In supplying a data signal to a line with the above-mentioned changeover switch, While choosing the column line of n flat knot in a certain partial column line driver, in supplying a black status signal to a line, Easy control of choosing the column line of n flat knot in the partial column line driver located in the back row of the above-mentioned partial column line driver can perform selection operation of the column line of the above-mentioned (n+m) book.

[0145]The liquid crystal display of the 3rd above-mentioned invention or the 4th invention, If the switching control signal of the above-mentioned changeover switch which is one of the control signals from the above-mentioned display control part to the above-mentioned line driver is set up make selection time of the above-mentioned data signal longer than the selection time of a black status signal, feed time of the above-mentioned data signal can be made longer than the feed time of the above-mentioned black status signal. Therefore, the picture element density of a display panel is high density, and since there are many column lines, it can be coped with also when data signal feed time cannot fully be taken.

[0146]The liquid crystal display of the 3rd above-mentioned invention or the 4th invention, If the switching control signal of the above-mentioned changeover switch which is one of the control signals from the above-mentioned display control part to the above-mentioned line driver is set up make equal selection time of the above-mentioned data signal, and selection time of a black status signal, feed time of the above-mentioned data signal and feed time of the above-mentioned black status signal can be made equal. Therefore, supply of the above-mentioned data signal and supply of the above-mentioned black status signal can be switched by very easy switching control processing.

[0147]Based on the recognition signal which is one of the control signals from the above-mentioned display control part to the above-mentioned column line driver as for the liquid crystal display of an invention of the above 4th, If the above-mentioned selection signal is supplied to the column line of a flat knot (n+m) - (n+m+k-1) a flat knot with the above-mentioned column line driver at the above-mentioned black status signal days of supply, by the time a data signal is impressed next, the above-mentioned black status signal can be supplied k times. Therefore, a black display can be ensured even when the above-mentioned black status signal feed time is insufficient. Therefore, according to this invention, the picture element density of a display panel is high density, and since there are many column lines, even when black status signal feed time cannot be taken enough, high-definition animation display to which the optical leakage of a back light does not take place can be performed.

[0148]The liquid crystal display invention of an invention of the above 4th, While supplying the

scanning start signal as one of the above-mentioned control signals to the 1st latch circuitry of a shift register at the data signal days of supply, the above-mentioned column line driver, If it is made to have a scan start signal supply means which supplies the above-mentioned scanning start signal to k latch circuitry which continued from the m-th latch circuitry of the above-mentioned shift register at the black status signal days of supply, The column line driver who is an easy change of providing a scan start signal supply means in the column line driver which has a shift register, and can supply a black status signal k times by the time a data signal is impressed next is realizable.

[0149]If the liquid crystal display of an invention of the above 4th is accomplished so that the latch circuitry number m and the number k of latch circuitry can be changed, [in / for the above-mentioned scan start signal supply means / the above-mentioned black status signal days of supply] By changing the latch circuitry number m, the display time of a black image until a data signal is impressed next can be changed. The number of times of supply of a black status signal until a data signal is impressed next can be changed by changing the number k of latch circuitry. Therefore, according to this invention, change of the picture element density of the above-mentioned display panel, change of environmental temperature, etc. can be coped with easily.

[0150]If the control signal which sets up the above-mentioned latch circuitry number m by a supply control means based on the scan start tab-control-specification signal from the outside is outputted to the above-mentioned scan start signal supply means, the liquid crystal display of an invention of the above 4th, Based on the signal from the outside, the display time of a black image until a data signal is impressed next can be changed.

[0151]The liquid crystal display of the 3rd above-mentioned invention or the 4th invention, If it is made to carry out the change output of the control signal for the 1st display mode which performs supply operation of the above-mentioned black status signal for the above-mentioned display control part according to the command signal from the outside, and the control signal for the 2nd display mode which does not perform supply operation of the above-mentioned black status signal, Waste of energy can be prevented as compared with the case where the display mode is always fixed to the 1st mode with much energy consumption.

[0152]The liquid crystal display of the 3rd above-mentioned invention or the 4th invention, If the change of the voltage of the reference supply for signals which sets up the voltage of the data signal supplied from the above-mentioned line driver is enabled in the time of the 1st display mode of the above, and the 2nd display mode, When the transmissivity of a liquid crystal is the 1st display mode of the above that becomes low, the voltage of a data signal can be set up according to the transmissivity fall of the above-mentioned liquid crystal. Therefore, fixed gradation balance can be maintained now between the 1st display mode and the 2nd display mode.

[0153]The liquid crystal display of the 3rd above-mentioned invention or the 4th invention, If it is made to output the above-mentioned command signal which distinguishes whether it is an animation or it is a still picture and with which a discriminated result is expressed by an animation still picture discriminating means to the above-mentioned display control part, The control signal for the 1st display mode is automatically outputted from the above-mentioned display control part at the time of the animation display to which display quality falls easily, and to all the picture elements, by the time a data signal is impressed next, a black image can be displayed. Therefore, it can detect automatically that the display image changed to the animation, and improvement in display quality can be aimed at.

[0154]The liquid crystal display of the 3rd above-mentioned invention or the 4th invention, By a back light control means, if the luminosity of a back light is switched with the 1st display mode of the above, and the 2nd display mode based on the above-mentioned command signal, when the transmissivity of a liquid crystal is the 1st display mode that becomes low, the luminosity of the above-mentioned back light can be raised. Therefore, it compares, when it fixes the luminosity of the above-mentioned back light according to the time of the 1st display mode of the above, and waste of the energy at the time of the 2nd display mode of the above can be prevented.

[0155]The liquid crystal display of the 3rd above-mentioned invention or the 4th invention, If the

voltage of the power supply for black status signals as the above-mentioned black status signal generating means is switched in the time of the 1st display mode of the above, and the 2nd display mode, fixed gradation balance can be maintained between the 1st display mode and the 2nd display mode.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a figure showing the outline composition in the liquid crystal display of this invention.
[Drawing 2]It is a figure showing the outline composition of the source driver in drawing 1.
[Drawing 3]Drawing 2 is a figure showing the outline composition of a different source driver.
[Drawing 4]It is a figure showing the outline composition of the gate driver in drawing 1.
[Drawing 5]It is an explanatory view when the analog switch in drawing 4 operates.
[Drawing 6]It is a timing chart of the selection signal outputted to the driving signal and each gate line of three gate drivers in a 1st embodiment.
[Drawing 7]It is an explanatory view of a picture used for explanation of cine mode display operation.
[Drawing 8]It is a figure showing the conventional image display sequence.
[Drawing 9]It is an explanatory view of a blot produced in the picture shown in drawing 7.
[Drawing 10]It is a figure showing the transmittance change for every [in the stabilimentum picture element based on the conventional image display sequence] frame.
[Drawing 11]It is a figure showing the image display sequence in the liquid crystal display shown in drawing 1.
[Drawing 12]It is a figure showing the indication results of the picture shown in drawing 7 based on the image display sequence shown in drawing 11.
[Drawing 13]It is a figure showing the transmittance change for every frame based on the image display sequence shown in drawing 11.
[Drawing 14]It is a figure showing the situation of movement of the stabilimentum in the arbitrary horizontal lines of the picture shown in drawing 7.
[Drawing 15]It is a figure showing the response waveform of the transmissivity in the conventional image display sequence at the time of making response time of a liquid crystal into the infinitesimal.
[Drawing 16]It is a figure showing the response waveform of the transmissivity in the image display sequence shown in drawing 11 at the time of making response time of a liquid crystal into the infinitesimal.
[Drawing 17]It is a figure showing movement of the stabilimentum in the conventional image display sequence, and movement of human being's viewpoint.
[Drawing 18]It is a figure showing the state where originate in the gap with movement of stabilimentum and movement of human being's viewpoint which are shown in drawing 17, and the

luminosity of both the edge of stabilimentum falls.
[Drawing 19]It is a figure showing movement of the stabilimentum in an image display sequence and movement of human being's viewpoint which are shown in drawing 11.
[Drawing 20]It is a figure showing the state where originate in the gap with movement of stabilimentum and movement of human being's viewpoint which are shown in drawing 19, and the luminosity of both the edge of stabilimentum falls.
[Drawing 21]It is a figure showing the relation of the write voltage and transmissivity in the image display sequence shown in drawing 11, and the conventional image display sequence.
[Drawing 22]It is a figure showing aging of the transmissivity in each gradation in the image display sequence shown in drawing 11, and the conventional image display sequence.
[Drawing 23]Drawing 6 is a different timing chart of a driving signal and a selection signal.
[Drawing 24]Drawing 11 is a figure showing a different image display sequence.
[Drawing 25]It is a timing chart of the driving signal in a 2nd embodiment, and a selection signal.
[Drawing 26]It is a timing chart following drawing 25.
[Drawing 27]Drawing 11 and drawing 24 are the figures showing a different image display sequence.
[Drawing 28]It is a figure showing the transmittance change for every frame based on the image display sequence shown in drawing 27.
[Drawing 29]Drawing 25 is a different timing chart.
[Drawing 30]It is a figure showing the image display sequence of drawing 29.
[Drawing 31]It is an outline lineblock diagram of the source driver in the conventional liquid crystal display.
[Description of Notations]
11 -- A liquid crystal panel, 12 -- A source driver and 13 -- Gate driver, 20 -- A display control part and 21 -- An animation / still picture discrimination circuit, 22 -- The reference supply for signals, 23 -- A back light light control circuit, 24 -- The power supply for black signals, 31, 37 -- Sampling memory, 32, 38 [-- A black signal data generating part, 41 / -- A shift register and 42 / -- An output circuit, 43 / -- Analog switch.] -- A holding memory, 33, 38 -- A DA converter, 34, 35 -- A changeover switch and 36

[Translation done.]

* NOTICES *

DRAWINGS

[Drawing 1]

23～ バックライト調光回路

21～ 動画／静止画判別回路

22～ 信号用基準電源

24～ 黒信号用電源

20 表示制御部

映像信号

映像信号

クロック信号

走査開始信号

識別信号

クロック信号

12 ソースドライバ　12 ソースドライバ　12 ソースドライバ

13a 第1ゲートドライバ

13b 第2ゲートドライバ

13c 第3ゲートドライバ

液晶パネル

16　17　G₁　S₁　S₆₄₀　G₄₈₀　14　15　18　11

[Drawing 2]

サンプリングクロック

22～ 信号用基準電源

切替クロック

映像信号

サンプリングメモリ 31 → ホールディングメモリ 32 → DAコンバータ 33 → 切替スイッチ 34 → ソースラインSへ

12

24～ 黒信号用電源

[Drawing 3]

サンプリングクロック

切替クロック

信号用基準電源 ～22

映像信号

サンプリングメモリ 37 → 切替スイッチ 35 → ホールディングメモリ 38 → DAコンバータ 39 → ソースラインSへ

黒信号データ生成部 ～36

12

[Drawing 4]

43

識別信号 → AS

走査開始信号

クロック信号

シフトレジスタ 41

ゲート電圧

出力回路 42

13　　G₁　G₂　G₃　G₄　……　G₁₅₉　G₁₈₀

[Drawing 7]

(A)

51　　51

54　　52

[Drawing 8]

1フレーム約16.7ms

サンプリング
期間 | 1ライン目 | 2ライン目 | 3ライン目 | ……… | 480ライン目

書き込み
期間 | 1ライン目 | 2ライン目 | 3ライン目 | ……… | 480ライン目

[Drawing 9]

(A)

51   51
53   52

[Drawing 10]

第1フレーム 第2フレーム 第3フレーム 第4フレーム 第5フレーム

[Drawing 13]

a   a   a

第1フレーム 第2フレーム 第3フレーム 第4フレーム 第5フレーム

[Drawing 18]

網膜上の輝度

位置

[Drawing 5]

[Drawing 6]

ゲートドライバ 13a — クロック信号 / 走査開始時間 / 識別信号 / ゲートライン G（1, 2, n, n+1, n+2, n+3, n+4, 159, 160）

ゲートドライバ 13b — クロック信号 / 走査開始時間 / 識別信号 / ゲートライン G（1, 2, n, n+1, n+2, n+3, n+4, 158, 159, 160）

ゲートドライバ 13c — クロック信号 / 走査開始時間 / 識別信号 / ゲートライン G（1, 2, n, n+1, n+2, n+3, n+4, 158, 159, 160）

[Drawing 11]

(a)

1フレーム約16.7ms

サンプリング期間： 1ライン目 | 2ライン目 | 3ライン目 | ……… | 480ライン目

書き込みおよびリセット期間： 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10

(b)
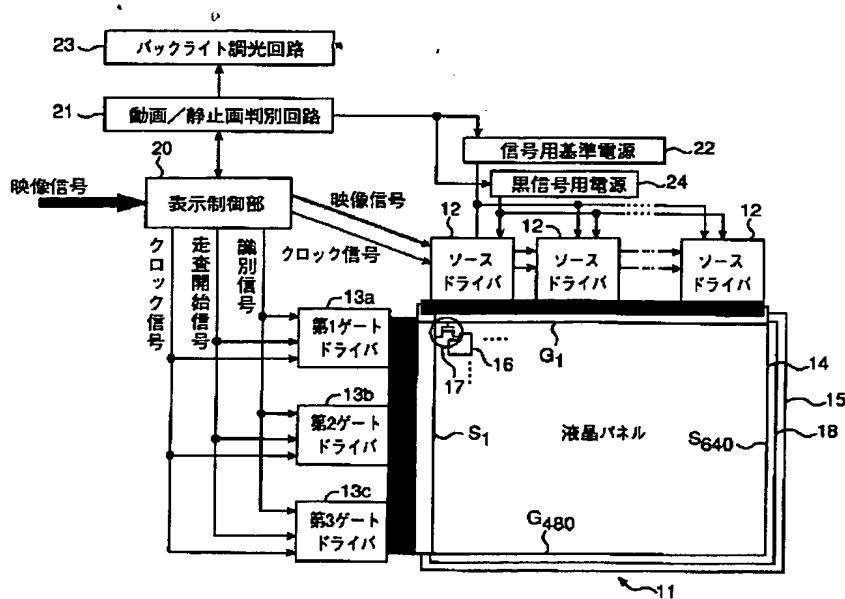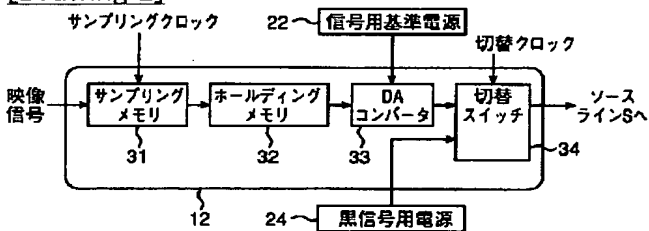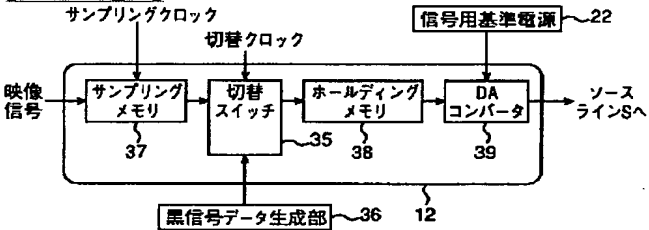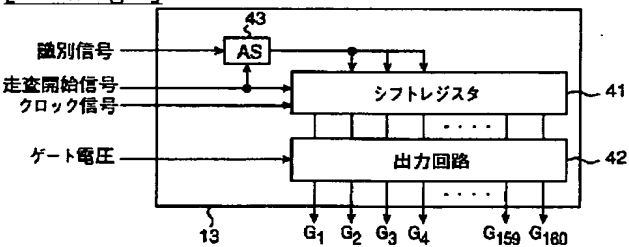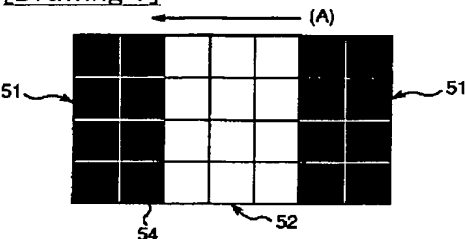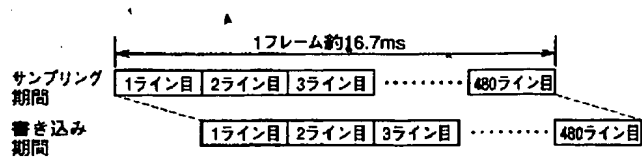
番号	駆動状態	
1	1ライン目データ	信号書き込み
2	161ライン目リセット	信号書き込み
3	2ライン目データ	信号書き込み
4	162ライン目リセット	信号書き込み
5	3ライン目データ	信号書き込み
6	163ライン目リセット	信号書き込み
7	nライン目データ	信号書き込み
8	(160+n)ライン目リセット	信号書き込み
9	480ライン目データ	信号書き込み
10	160ライン目リセット	信号書き込み

[Drawing 12]

[Drawing 14]
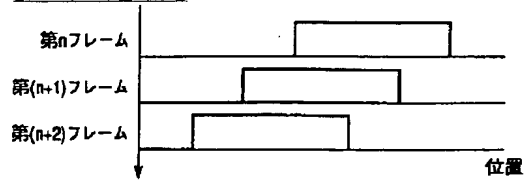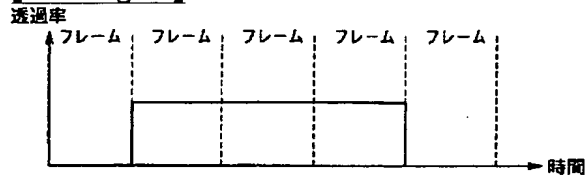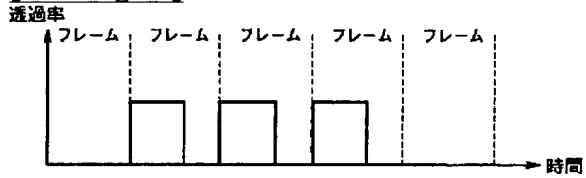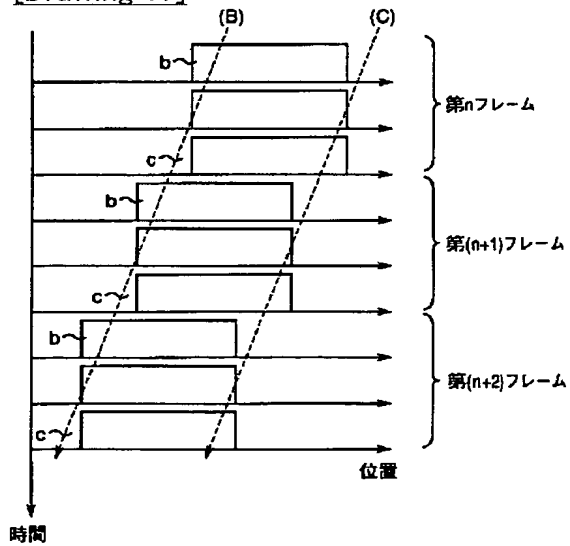
第nフレーム

第(n+1)フレーム

第(n+2)フレーム

位置

[Drawing 15]

透過率

フレーム | フレーム | フレーム | フレーム | フレーム

時間

[Drawing 16]

透過率

フレーム | フレーム | フレーム | フレーム | フレーム

時間

[Drawing 17]

第nフレーム

第(n+1)フレーム

第(n+2)フレーム

位置

時間

[Drawing 19]

(B) (C)

b
c

第nフレーム

b
c

第(n+1)フレーム

b
c

第(n+2)フレーム

位置

時間

[Drawing 20]

網膜上の輝度

本実施の形態

従来

位置

[Drawing 21]

透過率

従来

本実施の
形態

電圧

[Drawing 24]

1フレーム約16.7ms

サンプリング
期間

| 1ライン目 | 2ライン目 | 3ライン目 | ……… | 480ライン目 |

書き込みおよび
リセット期間

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

[Drawing 28]

a   a   a   a   ……

第1フレーム   第2フレーム   第3フレーム   第4フレーム   ……

[Drawing 22]

(a)　透過率　　　本実施の形態

時間

(a)　透過率　　　従来

時間
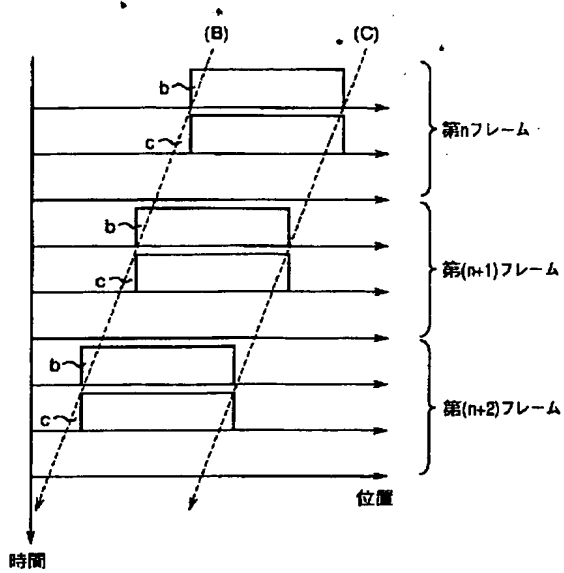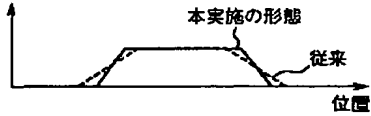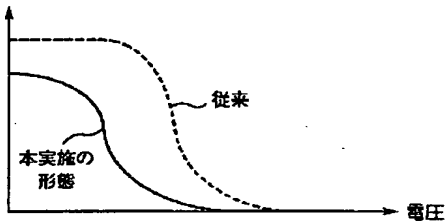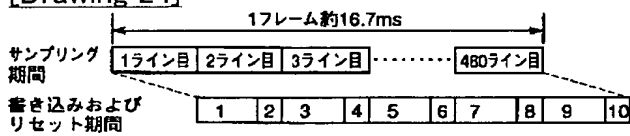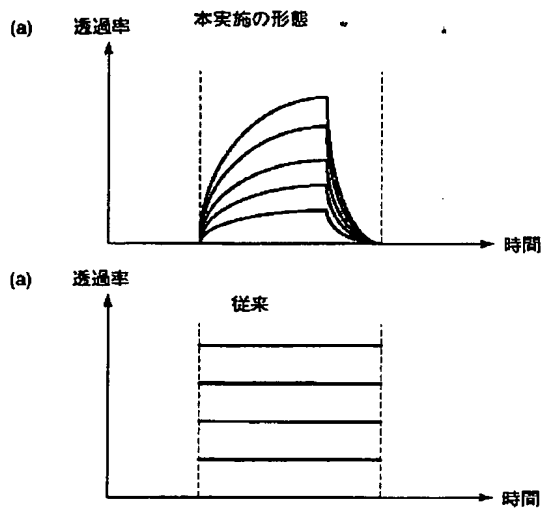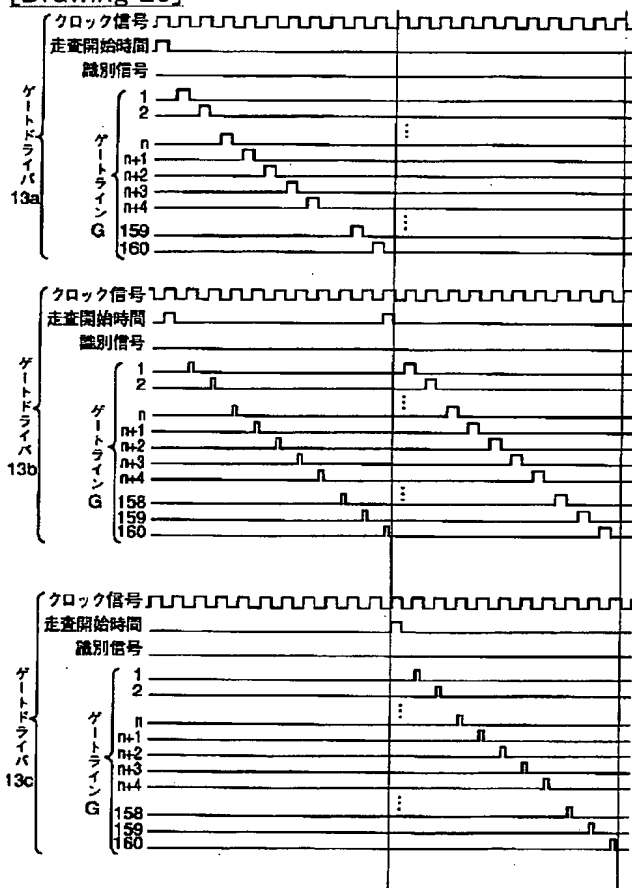
[Drawing 23]

[Drawing 26]

[Drawing 25]

[Drawing 27]

(a)

(b)
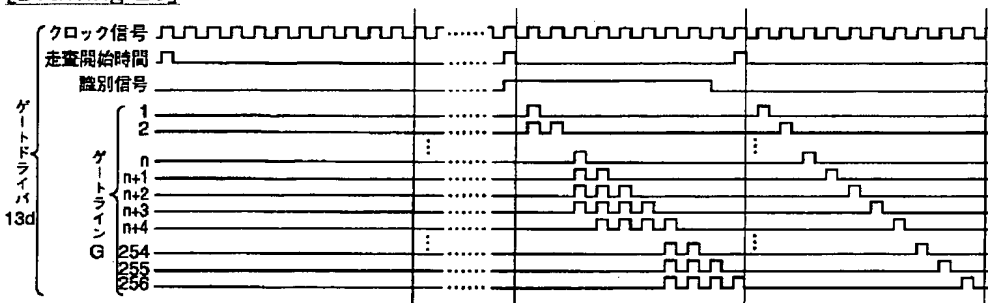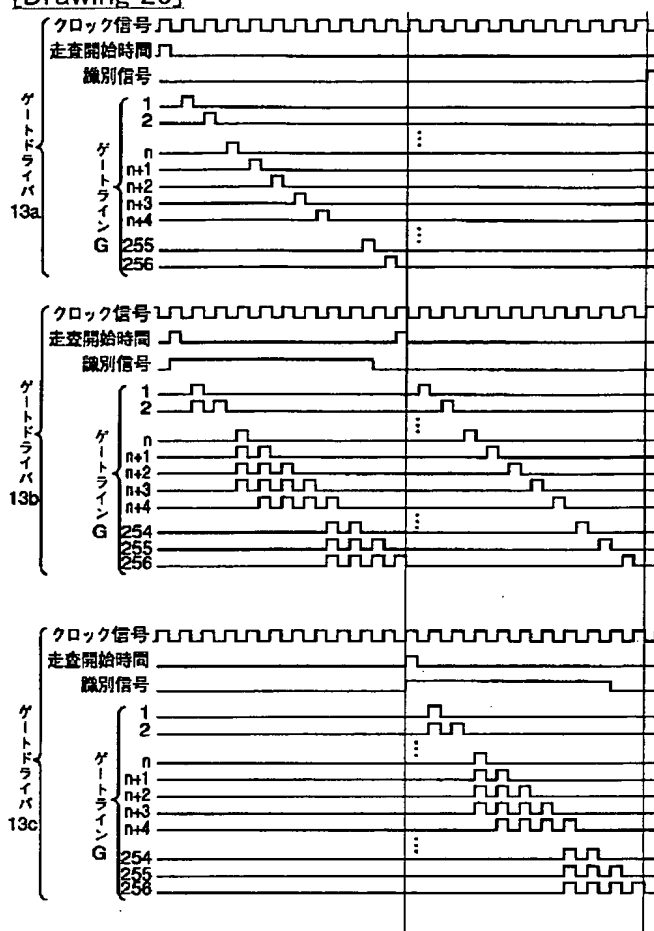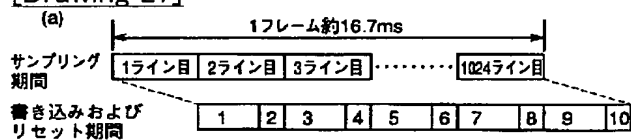
番号	駆動状態
1	1ライン目データ 信号書き込み
2	257～260 ライン目リセット 信号書き込み
3	2ライン目データ 信号書き込み
4	258～261 ライン目リセット 信号書き込み
5	3ライン目データ 信号書き込み
6	259～262 ライン目リセット 信号書き込み
7	nライン目データ 信号書き込み
8	(256+n)～(259+n) ライン目リセット 信号書き込み
9	1024ライン目データ 信号書き込み
10	256～259 ライン目リセット 信号書き込み

[Drawing 29]

[Drawing 30]

(a)

1フレーム約16.7ms

サンプリング期間　| 1ライン目 | 2ライン目 | 3ライン目 | ……… | 1024ライン目 |

書き込みおよびリセット期間　| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

(b)
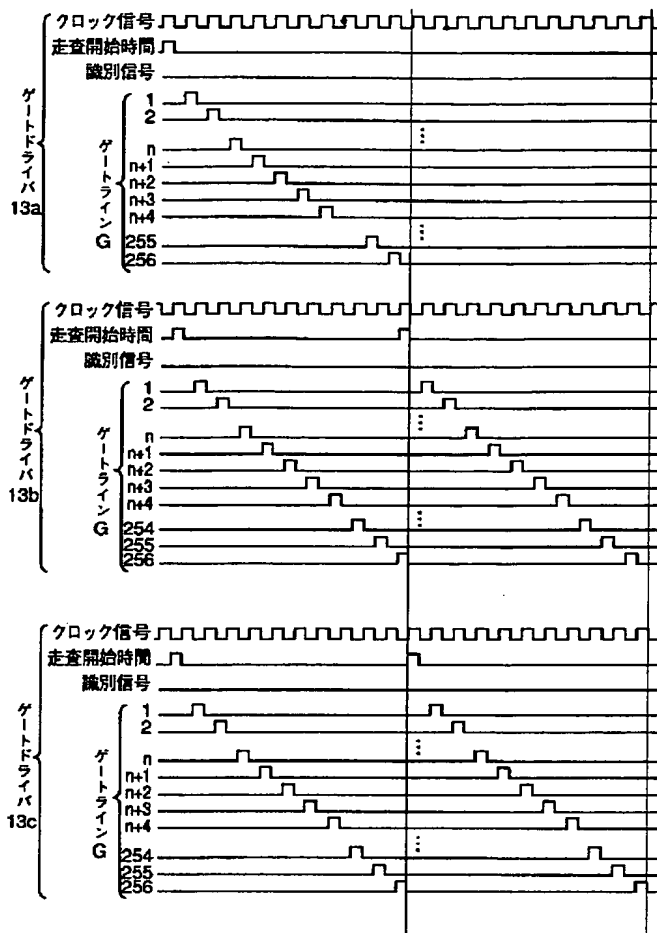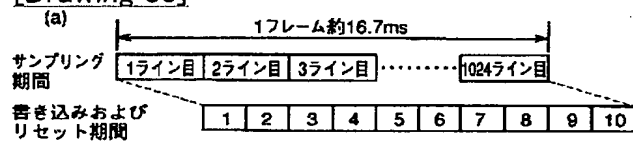
番号	駆動状態	
1	1ライン目データ	信号書き込み
2	257,513ライン目リセット	信号書き込み
3	2ライン目データ	信号書き込み
4	258,514ライン目リセット	信号書き込み
5	3ライン目データ	信号書き込み
6	259,515ライン目リセット	信号書き込み
7	nライン目データ	信号書き込み
8	(256+n),(512+n)ライン目リセット	信号書き込み
9	480ライン目データ	信号書き込み
10	256,512ライン目リセット	信号書き込み

[Drawing 31]

クロック信号

映像信号

5
信号用基準電源

1

6
6
6
6

2
サンプリング
メモリ

3
ホールディング
メモリ

4
DA
コンバータ

[Translation done.]

(54)【発明の名称】　　液晶表示方法および液晶表示装置

(57)【要約】

【課題】　最小限の改良によって動画表示品位を向上する。

【解決手段】　ソースドライバ12は、データ信号とリセット(黒)信号とを交互にソースラインSに出力する。480本のゲートラインGは、160本ずつ3グループに分割されてゲートドライバ13a〜13cに接続される。表示制御部20は、識別信号,走査開始信号及びクロック信号を各ゲートドライバ13に出力して、ソースドライバ12がデータ信号を出力する場合はn番目のゲートラインGを選択させ、リセット信号を出力する場合は(n＋160)番目のゲートラインGを選択させる。さらに、nを順次シフトさせる。このように、1フレームの後半1/3にリセット信号を書き込むことによって、白表示から黒表示に切り換えた絵素の光漏れをなくす。また、動画像のエッジ部の滲みを低減する。こうして、最小限の改良で動画表示品位の向上を図る。
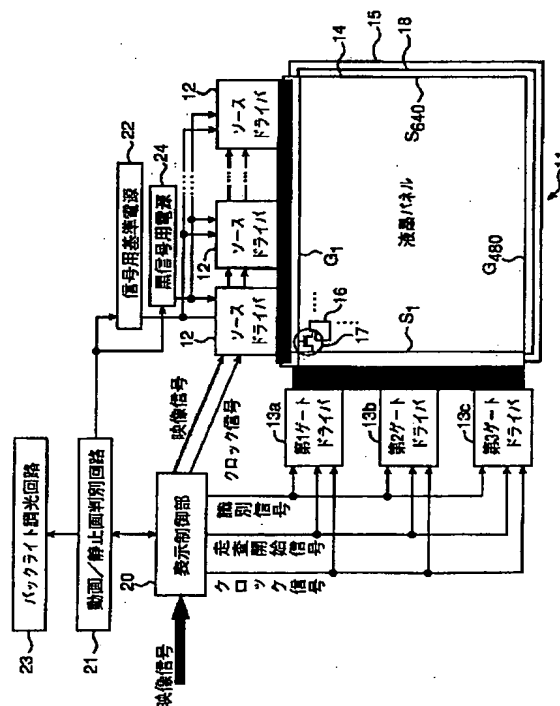
一方、上記行線ドライバに制御信号を供給して、上記表示パネルに対する画像表示動作を制御する表示制御部と、

上記絵素に黒画像を表示させるための黒表示信号を発生する黒表示信号発生手段と、

上記列線ドライバに設けられて、上記表示制御部からの映像信号に基づくデータ信号と上記黒表示信号発生手段からの黒表示信号とを交互に切り替え選択する切替スイッチを備えて、

上記表示制御部は、上記行線を順次選択させるための上記制御信号を上記行線ドライバに供給すると共に、上記切替スイッチがデータ信号を選択している際にはn本目の行線に選択信号を供給させる一方、上記切替スイッチが黒表示信号を選択している際には(n＋m)本目の行線に選択信号を供給させることを特徴とする液晶表示装置。

【請求項１１】　互いに平行に配列された複数の列線，上記列電極に交差する方向に互いに平行に配列された複数の行線，上記列線と上記行線との交差位置あるいは交差位置近傍の液晶でなる絵素が少なくとも形成された表示パネルと、上記列線にデータ信号を供給する列線ドライバと、上記行線に選択信号を供給する行線ドライバを有する液晶表示装置において、

上記列線ドライバに映像信号および制御信号を供給する一方、上記行線ドライバに制御信号を供給して、上記表示パネルに対する画像表示動作を制御する表示制御部と、

上記絵素に黒画像を表示させるための黒表示信号を発生する黒表示信号発生手段と、

上記列線ドライバに設けられて、上記表示制御部からの映像信号に基づくデータ信号と上記黒表示信号発生手段からの黒表示信号とを交互に切り替え選択する切替スイッチを備えて、

上記表示制御部は、上記行線を順次選択させるための上記制御信号を上記行線ドライバに供給すると共に、上記切替スイッチがデータ信号を選択している際にはn本目の行線に選択信号を供給させる一方、上記切替スイッチが黒表示信号を選択している際には上記n本目の行線とは異なる複数本の行線に選択信号を供給させることを特徴とする液晶表示装置。

【請求項１２】　請求項１０あるいは請求項１１に記載の液晶表示装置において、

上記行線は、m本毎にL(L：正の整数)個のブロックに分割され、

上記行線ドライバは、各ブロックの行線に選択信号を供給するL個の部分行線ドライバで構成されていることを特徴とする液晶表示装置。

【請求項１３】　請求項１０乃至請求項１２の何れか一つに記載の液晶表示装置において、

上記表示制御部から上記列線ドライバへの制御信号は、

上記切替スイッチの切替動作を制御するための切替制御信号を含み、

上記切替制御信号は、上記データ信号の選択時間を黒表示信号の選択時間よりも長くするようになっていることを特徴とする液晶表示装置。

【請求項１４】　請求項１０乃至請求項１２の何れか一つに記載の液晶表示装置において、

上記表示制御部から上記列線ドライバへの制御信号は、上記切替スイッチの切替動作を制御するための切替制御信号を含み、

上記切替制御信号は、上記データ信号の選択時間と上記黒表示信号の選択時間とを等しくするようになっていることを特徴とする液晶表示装置。

【請求項１５】　請求項１１あるいは請求項１２に記載の液晶表示装置において、

上記表示制御部から上記行線ドライバへの制御信号は、上記黒表示信号を供給する黒表示信号供給期間であるか否かを識別するための識別信号を含み、

上記行線ドライバは、上記識別信号に基づいて、上記黒表示信号供給期間には(n＋m)本目から(n＋m＋k－1)本目までの行線に上記選択信号を供給するようになっていることを特徴とする液晶表示装置。

【請求項１６】　請求項１５に記載の液晶表示装置において、

上記表示制御部から上記行線ドライバへの制御信号は走査開始信号を含み、

上記行線ドライバは、

複数のラッチ回路を有するシフトレジスタと、

上記識別信号に基づいて、データ信号供給期間には上記走査開始信号を上記シフトレジスタの１番目のラッチ回路に供給する一方、黒表示信号供給期間には上記走査開始信号を上記シフトレジスタのm番目のラッチ回路から連続したk個のラッチ回路に供給する走査開始信号供給手段を備えていることを特徴とする液晶表示装置。

【請求項１７】　請求項１６に記載の液晶表示装置において、

上記走査開始信号供給手段は、上記黒表示信号供給期間におけるラッチ回路番号mとラッチ回路数kを変更可能になっていることを特徴とする液晶表示装置。

【請求項１８】　請求項１７に記載の液晶表示装置において、

上記走査開始信号供給手段の動作を制御する供給制御手段を備えて、

上記供給制御手段は、外部からの走査開始位置指定信号に基づいて、上記ラッチ回路番号mを設定する制御信号を上記走査開始信号供給手段に出力することを特徴とする液晶表示装置。

【請求項１９】　請求項１０乃至請求項１２の何れか一つに記載の液晶表示装置において、

上記表示制御部は、外部からの指令信号に応じて、上記

トでは、上記上画面を黒信号(ブランキング)走査すると同時に下画面も黒信号(ブランキング)走査している。このようにして、スロット毎に順次信号走査と黒信号(ブランキング)走査を繰り返している。したがって、上画面を走査し始めるときに下画面も同時に走査する必要があり、一度、１ライン分の画像データを記憶させておく必要がある。したがって、回路が複雑化して、コストアップにつながるという問題がある。

【００１０】また、上記文献１に開示された液晶表示方法も同様の問題がある。すなわち、１フレーム時間を前半と後半とに分割し、さらに画面を上下２分割している。そして、１フレーム時間の前半では、上画面を信号走査すると同時に下画面を黒信号(ブランキング)走査する。一方、１フレーム時間の後半では、上画面を黒信号(ブランキング)走査すると同時に下画面を信号走査している。この場合には、上記文献２のような画像データの記憶は不要であるが、画面分割による回路の複雑化とコストアップという不具合はやはり生じる。

【００１１】言うまでもないが、画面を分割化すると、例えばソースドライバが上下で２倍必要になり、コストアップになるのである。

【００１２】そこで、この発明の目的は、文献１及び文献２のような画面分割は行わずに、特別な画面の記憶装置も必要とせずに、従来の液晶表示装置の最小限の改良によって動画表示品位を向上できる液晶表示方法および液晶表示装置を提供することにある。

【００１３】

【課題を解決するための手段】上記目的を達成するため、第１の発明は、互いに平行に配列された複数の列線にデータ信号を供給し，上記列線に交差する方向に互いに平行に配列された複数の行線に選択信号を供給して，上記データ信号が供給された列線と上記選択信号が供給された行線との交差位置あるいは交差位置近傍の液晶でなる絵素に画像を表示する液晶表示方法であって、ｎ(ｎ：正の整数)本目の行線に上記選択信号を供給すると共に，上記列線にデータ信号を供給して，上記ｎ本目の行線と各列線との交差位置に係る絵素に上記データ信号に基づく画像を表示し、次に、ｍを正の整数として(ｎ＋ｍ)本目の行線に上記選択信号を供給すると共に，絵素に黒画像を表示させるための黒表示信号を上記列線に供給して，上記(ｎ＋ｍ)本目の行線と各列線との交差位置に係る絵素に上記黒画像を表示し、上記選択信号を供給する行線を順次シフトさせながら上記データ信号に基づく画像の表示動作と黒画像の表示動作とを繰り返し、上記選択信号を供給する(ｎ＋ｍ)本目の行線が最終行線を越える場合には，先頭行線に戻って１フレーム期間内に全絵素の夫々に対して上記データ信号に基づく画像および黒画像を表示することを特徴としている。

【００１４】上記構成によれば、上記文献１および文献２の場合とは異なり、列線へのデータ信号供給と黒表示

信号供給とが交互に行われ、上記選択信号を供給する行線が上記信号供給に同期して、ｎ，ｎ＋ｍ，ｎ＋１，ｎ＋ｍ＋１，ｎ＋２，ｎ＋ｍ＋２，…のごとくｎが順次増加される。こうして、画面を分割したり、１画面の画像データを記憶する回路を用いたりすることなく、総ての絵素に対して、データ信号が書き込まれ、さらにｍに応じた所定時間が経過した後に黒表示信号が供給され、次のフレームに新たに画像データ信号が書き込まれるまで黒表示信号が書き込まれた状態が保持されて、黒画像が表示される。したがって、白表示を行っている絵素が次のフレームで黒表示に変わる場合は、黒表示信号が書き込まれる前に既に黒画像が表示されていることになり、バックライトの光り漏れは起こらないのである。

【００１５】また、動画における映像のエッジは、フレームの切り変わりで移動してフレーム期間には停止している。ところが、人間には映像は滑らかに移動していると感じられるために、映像のエッジが人間の視線よりも先に在る期間と後に在る期間とがあり、映像のエッジが滲んで見える。ところが、この発明においては、上述のように、上記映像を表示している絵素が次にデータ信号が印加されるまでに黒表示になって映像が消えるため、結果として映像のエッジが人間の視線よりも先に在る期間と後に在る期間とが短くなり、映像のエッジの滲みが低減されることになる。こうして、動画表示品位が向上される。

【００１６】また、第２の発明は、互いに平行に配列された複数の列線にデータ信号を供給し，上記列線に交差する方向に互いに平行に配列された複数の行線に選択信号を供給して，上記データ信号が供給された列線と上記選択信号が供給された行線との交差位置あるいは交差位置近傍の液晶でなる絵素に画像を表示する液晶表示方法であって，ｎ本目の行線に上記選択信号を供給すると共に，上記列線にデータ信号を供給して，上記ｎ本目の行線と各列線との交差位置に係る絵素に上記データ信号に基づく画像を表示し、次に、上記ｎ本目の行線とは異なる複数本の行線に上記選択信号を同時に供給すると共に，絵素に黒画像を表示させるための黒表示信号を上記列線に供給して，上記複数本の行線と各列線との交差位置に係る絵素に上記黒画像を表示し、上記選択信号を供給する行線を順次シフトさせながら上記データ信号に基づく画像の表示動作と黒画像の表示動作とを繰り返し、上記同時に選択信号を供給する複数本の行線が最終行線を越える場合には，先頭行線に戻って１フレーム期間内に全絵素の夫々に対して上記データ信号に基づく画像および黒画像を表示することを特徴としている。

【００１７】上記構成によれば、総ての絵素に対して、１フレーム期間の後半に複数回黒表示信号が供給される。したがって、上記黒表示信号供給時間が１回の黒表示信号供給だけでは十分な黒画像表示が行えない時間である場合でも、黒表示信号供給が複数回繰り返されるこ

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ように制御される。すなわち、上記列線ドライバの切替スイッチによってデータ信号が選択されて列線に供給される場合には、上記行線ドライバによってｎ本目の行線が選択される。一方、上記切替スイッチによって黒表示信号が選択されて列線に供給される場合には、（ｎ＋ｍ）本目の行線が選択される。こうして、総ての絵素に対して、データ信号が書き込まれ、さらにｍに応じた所定時間が経過した後に黒表示信号が供給され、次のフレームに新たに画像データ信号が書き込まれるまで黒表示信号が書き込まれた状態が保持されて、黒画像が表示される。したがって、白表示を行っている絵素が次のフレームで黒表示に変わる場合は、黒表示信号が書き込まれる前に既に黒画像が表示されていることになり、バックライトの光り漏れは起こらないのである。

【００３４】また、第４の発明は、互いに平行に配列された複数の列線，上記列電極に交差する方向に互いに平行に配列された複数の行線，上記列線と上記行線との交差位置あるいは交差位置近傍の液晶でなる絵素が少なくとも形成された表示パネルと，上記列線にデータ信号を供給する列線ドライバと，上記行線に選択信号を供給する行線ドライバを有する液晶表示装置において、上記列線ドライバに映像信号及び制御信号を供給する一方，上記行線ドライバに制御信号を供給して，上記表示パネルに対する画像表示動作を制御する表示制御部と、上記絵素に黒画像を表示させるための黒表示信号を発生する黒表示信号発生手段と、上記列線ドライバに設けられて，上記表示制御部からの映像信号に基づくデータ信号と上記黒表示信号発生手段からの黒表示信号とを交互に切り替え選択する切替スイッチを備えて、上記表示制御部は，上記行線を順次選択させるための上記制御信号を上記行線ドライバに供給すると共に，上記切替スイッチがデータ信号を選択している際にはｎ本目の行線に選択信号を供給させる一方，上記切替スイッチが黒表示信号を選択している際には上記ｎ本目の行線とは異なる複数本の行線に選択信号を供給させることを特徴としている。

【００３５】上記構成によれば、表示制御からの制御信号に基づいて、行線ドライバおよび列線ドライバが次のように制御される。すなわち、上記列線ドライバの切替スイッチによってデータ信号が選択されて列線に供給される場合には、上記行線ドライバによってｎ本目の行線が選択される。一方、上記切替スイッチによって黒表示信号が選択されて列線に供給される場合には、ｎ本目とは異なる複数本の行線が選択される。したがって、上記黒表示信号供給時間が１回の黒表示信号供給だけでは十分な黒画像表示が行えない時間である場合でも、黒表示信号供給が複数回繰り返されることによって確実に黒表示が行われる。こうして、表示パネルの絵素密度が高密度であって行線数が多いために、黒表示信号供給時間が十分取れない場合でも、バックライトの光り漏れが起こらない高品位な動画表示が行われる。

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【００３６】また、上記第３の発明あるいは第４の発明の液晶表示装置は、上記行線をｍ本毎にＬ（Ｌ：正の整数）個のブロックに分割し、上記行線ドライバを各ブロックの行線に選択信号を供給するＬ個の部分行線ドライバで構成することが望ましい。

【００３７】上記構成によれば、上記切替スイッチによってデータ信号が列線に供給される場合には、ある１つの部分行線ドライバによって、当該部分行線ドライバに接続されたｎ本目の行線が選択される。一方、上記切替スイッチによって黒表示信号が列線に供給される場合には、上記部分行線ドライバの後列に位置する部分行線ドライバによって、当該部分行線ドライバに接続されたｎ本目の行線が選択される。こうして、簡単な制御によって（ｎ＋ｍ）本の行線の選択動作が行われる。

【００３８】また、上記第３の発明あるいは第４の発明の液晶表示装置は、上記表示制御部から上記列線ドライバへの制御信号は，上記切替スイッチの切替動作を制御するための切替制御信号を含み、上記切替制御信号は、上記データ信号の選択時間を黒表示信号の選択時間よりも長くするようになっていることが望ましい。

【００３９】上記構成によれば、上記データ信号の供給時間は上記黒表示信号の供給時間よりも長くなる。したがって、表示パネルの絵素密度が高密度であって行線数が多いために、データ信号供給時間が十分取れない場合にも対処できる。

【００４０】また、上記第３の発明あるいは第４の発明の液晶表示装置は、上記表示制御部から上記列線ドライバへの制御信号は，上記切替スイッチの切替動作を制御するための切替制御信号を含み、上記切替制御信号は、上記データ信号の選択時間と上記黒表示信号の選択時間とは等しくするようになっていることが望ましい。

【００４１】上記構成によれば、上記データ信号の供給時間と上記黒表示信号の供給時間とは等しいために、非常に簡単な切り換え制御処理によって上記データ信号の供給と上記黒表示信号の供給とが切り換えられる。

【００４２】また、上記第４の発明の液晶表示装置は、上記表示制御部から上記行線ドライバへの制御信号は，上記黒表示信号を供給する黒表示信号供給期間であるか否かを識別するための識別信号を含み、上記行線ドライバは，上記識別信号に基づいて，上記黒表示信号供給期間には（ｎ＋ｍ）本目から（ｎ＋ｍ＋ｋ－１）本目までの行線に上記選択信号を供給するようになっていることが望ましい。

【００４３】上記構成によれば、総ての絵素に対して、次にデータ信号が印加されるまでにｍに応じた所定時間中にｋ回黒表示信号が供給される。したがって、上記ｍに応じた黒表示信号供給時間が黒画像表示を行うためには不十分な時間である場合でも、黒表示信号供給がｋ回繰り返されることによって確実に黒表示が行われる。こうして、表示パネルの絵素密度が高密度であって行線数

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【００５９】上記構成によれば、１フレーム期間におい
て、データ信号が書きこまれた後に次のフレームにデー
タ信号が印加されるまで黒画像を表示する第１表示モー
ドの場合には、黒表示信号用電源の電圧が切り換えられ
て確実に黒表示が行われる。

【００６０】

【発明の実施の形態】以下、この発明を図示の実施の形
態により詳細に説明する。

＜第１実施の形態＞図１は、本実施の形態における液晶
表示装置としてのアクティブマトリックス型液晶表示装
置の概略構成図である。本実施の形態における液晶表示
装置は、液晶パネル１１と複数のソースドライバ１２と
複数のゲートドライバ１３を有している。液晶パネル１
１は、ＴＦＴ基板１４と対向基板１５を有しており、Ｔ
ＦＴ基板１４上には、マトリックス状に配列された絵素
電極１６と、この絵素電極１６にドレインが接続された
ＴＦＴ１７と、各行のＴＦＴ１７におけるゲートに共通
に接続されて平行に配列されたゲートラインＧと、各列
のＴＦＴ１７におけるソースに共通に接続されて平行に
配列されたソースラインＳが形成されている。また、Ｔ
ＦＴ基板１４に所定間隔で対向する対向基板１５には、
絵素電極１６に対向する対向電極１８が形成されてい
る。また、図示してはいないが、絵素電極１６と対向電
極１８との間には、液晶が挟持されている。

【００６１】ここで、本実施の形態における液晶パネル
１１は、上記ゲートラインＧが４８０本であり、ソース
ラインＳが６４０（カラー表示の場合には３倍）本である
ＶＧＡ（ビデオ・グラフィックス・アレイ）パネルを用いて
いる。そして、４８０本のゲートラインＧは、１６０本
ずつ３つのグループに分割されて各グループ毎に第１ゲ
ートドライバ１３ａ〜第３ゲートドライバ１３ｃに接続さ
れている。同様に、ソースラインＳは、複数のグループ
に分割されて各グループ毎にソースドライバ１２に接続
されている。

【００６２】表示制御部２０は、クロック信号生成手段
を有し、生成した上記クロック信号を入力された映像信
号と共に、１番目のソースドライバ１２に出力する。ま
た、走査開始信号生成手段および識別信号生成手段を有
し、生成した走査開始信号および識別信号をクロック信
号と共に各ゲートドライバ１３に出力する。動画／静止
画判別回路２１は、表示制御部２０から受けた映像信号
に基づいて、画面上の数点のデータをモニターすること
によって、動画像主体の動画か静止画像主体の静止画か
を判別する。そして、判別結果を表示制御部２０に返
す。そうすると、表示制御部２０は、上記判別結果に基
づいて上記クロック信号の一つである切替クロック信
号，識別信号および走査開始信号を動画用と静止画用と
の何れかに切り換えるのである。

【００６３】さらに、上記動画／静止画判別回路２１か
らの判別結果は、信号用基準電源２２，黒信号用電源２

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４およびバックライト調光回路２３にも出力される。そ
うすると、上記信号用基準電源２２及び黒信号用電源２
４は、上記判別結果に応じたデータ信号用基準電圧及び
黒信号用電圧を各ソースドライバ１２に送出する。ま
た、バックライト調光回路２３は、上記判別結果に応じ
てバックライト（図示せず）を調光する。尚、黒信号用電
源２４は、後に詳述するリセット信号（黒信号）を生成す
る際に用いられる電源である。

【００６４】図２は、上記ソースドライバ１２の概略構
成図である。但し、１本のソースラインＳに関する構成
で代表して表示しており、全てのソースラインＳに関し
て同様の構成のものが設けられている。映像信号から１
絵素（１水平ライン）分のデータがサンプリングメモリ３
１にサンプリングされ、このサンプリングされたデータ
がホールディングメモリ３２に蓄えられる。そして、Ｄ
Ａコンバータ３３によって信号用基準電源２２からの信
号用基準電圧を用いてＤＡ変換されて、切替スイッチ３
４に送出される。

【００６５】上記切替スイッチ３４には、上記サンプリ
ングメモリ３１，ホールディングメモリ３２およびＤＡ
コンバータ３３に供給されるサンプリングクロック信号
を分周したクロック信号であって、全ソースドライバ１
２，１２，…のサンプリングメモリ３１，３１，…に１水平
ライン分のデータがサンプリングされる時間を周期とす
る上記切替クロック信号が入力される。そして、切替ス
イッチ３４は、上記切替クロック信号のレベルが、例え
ば「Ｈ」の場合にはＤＡコンバータ３３からのデータ信号
を選択して対応するソースラインＳに出力する。一方、
「Ｌ」の場合には黒信号用電源２４からの黒信号電圧を選
択し、対応するソースラインＳに上記リセット信号とし
て出力するのである。

【００６６】尚、上記ソースドライバ１２は、図３に示
すように構成しても差し支えない。すなわち、図２に示
すソースドライバ１２においては、切替スイッチ３４を
ＤＡコンバータ３３の後段に位置させているが、図３に
おいては、切替スイッチ３５をホールディングメモリ３
８の前段に位置させるのである。そして、切替スイッチ
３５は、上記切替クロック信号のレベルが、例えば「Ｈ」
の場合にはサンプリングメモリ３７からの映像信号を選
択してホールディングメモリ３８に送出する。一方、
「Ｌ」の場合には黒信号データ生成部３６からの黒信号デ
ータを選択してホールディングメモリ３８に送出する。
そして、ＤＡコンバータ３８によって信号用基準電源２
２からの信号用基準電圧を用いてＤＡ変換されて、対応
するソースラインＳに出力される。こうして、１水平ラ
イン分のデータがサンプリングされる時間の前半には上
記映像信号に基づくデータ信号がソースラインＳに出力
される一方、後半には上記黒信号データに基づく上記リ
セット信号がソースラインＳに出力されるのである。

【００６７】図４は、上記ゲートドライバ１３の概略構

査開始信号と、全レベルが「Ｌ」である識別信号とが入力されるものとする。そうすると、図６に示すようにｎ番目のゲートラインＧが選択された後には(ｎ＋１６０)番目のゲートラインＧが選択される。更に、(ｎ＋１)番目のゲートラインＧが選択された後には(ｎ＋１６１)番目のゲートラインＧが選択される。但し、(ｎ＋ｍ)がライン数より多い場合には、最終ラインに続いて先頭ラインから数えて選択ラインが求められる。各ゲートラインＧの選択時間の幅は、ソースラインＳへの信号の出力時間の幅と同じく約１７μｓである。その場合、ソースドライバ１２が上記データ信号を出力する際にｎ番目のゲートラインＧを選択し、ソースドライバ１２が上記リセット信号を出力する際に(ｎ＋１６０)番目のゲートラインＧを選択するように、上記切替クロックと走査開始信号とのタイミングを設定しておく。

【００７６】上述のごとく、上記データ信号を出力したゲートラインＧの１６０本先のゲートラインＧ(ｍ＝１６０)に上記リセット信号を与えるのは、次の理由による。すなわち、液晶の透過率が１００％から１０％まで変化する応答時間は約４ｍｓである。そして、あるゲートラインＧに接続されたある絵素の絵素電極にリセット信号が印加された場合、次にデータ信号が印加されるまでに概ね黒表示になっている必要がある。したがって、次の関係が成立する。

ｆ×ｍ/Ｎ＞４ｍｓ

但し、ｆ：１フレーム時間（１６.７ｍｓ）

Ｎ：総ゲートライン数(４８０本)

したがって、ｍ＞１１５である必要がある。

【００７７】ここで、本実施の形態においては、１６０本のゲートラインＧに接続されたゲートドライバ１３を３個一直線状に配置して４８０本を走査するようになっている。したがって、ｍ＝１６０とすれば、現在データ信号を出力しているゲートドライバ１３の次のゲートドライバ１３から、データ信号が出力されているゲートラインＧの番号と同じ番号のゲートラインＧにリセット信号を出力するという非常に簡単な制御によって、ｍ＞１１５の条件をクリアできるのである。

【００７８】このような画像表示動作による表示結果について、従来の液晶表示装置による表示結果と比較すると次のようになる。ここで、説明に用いる画像は、図７に示すように、黒の背景５１の中央に３絵素分の幅を有する白帯５２が縦方向に配列されている。そして、この白帯５２は、矢印(Ａ)のごとく１フレーム毎に１絵素ずつ移動して行く動画像であるとする。

【００７９】先ず、従来の液晶表示装置による画像表示方法に付いて述べる。従来の液晶表示装置による１フレーム期間の画像表示シーケンスを図８に示す。次々送られてくる映像信号の１水平ライン分が、ソースドライバ１のサンプリングメモリ２にサンプリングされてホールディングメモリ３に一旦蓄えられる。そして、ホールデ

ィングメモリ３から読み出された１水平ライン分のデータ信号が、ゲートドライバによって選択された１水平ラインを構成する絵素行に書き込まれる。それと同時に、２水平ライン目のデータ信号がサンプリングメモリ２サンプリングされてホールディングメモリ３の内容が書き換えられる。これを４８０水平ライン分繰り返して１フレーム分のデータ信号書き込みが完了する。

【００８０】尚、液晶は、ノーマリホワイトタイプのＴＮ(捩れネマチック)モードを採用している。また、その特性は、透過率が０％→９０％に達する時間が約２０ｍｓであり、１００％→１０％に達する時間は約４ｍｓである。

【００８１】上述のような動画像を、従来の液晶表示装置の画像表示シーケンスによって表示した場合には、図９に示すように、白帯５２から背景５１に変化した絵素列５３に明らかな残像(画像の滲み)が見られる。この原因は、以下のように説明される。すなわち、図１０は、図７における白帯５２の進行方向前方において白帯５２に隣接する任意の絵素５４における各フレーム毎の透過率変化を示す。この透過率変化は、理想的には、第１フレームでは黒表示(透過率＜１０％)であり、第２フレーム～４フレームまでは白表示(透過率＞９０％)であり、第５フレームでは再び黒表示に戻るはずである。ところが、上述のように、透過率が０％から９０％に達するまでの時間が約２０ｍｓであり、１００％から１０％に達するまでの時間が約４ｍｓという液晶の特性を有している。そのために、第１フレームでは黒表示であった絵素５４に第２フレームで白信号を書き込んだ場合に、絵素５４の液晶はフレーム時間内に応答を完了できずに第３フレームで略完了することになる。したがって、第４フレームでは本来の白表示となる。そして、第５フレームでは黒信号が書き込まれるのであるが、透過率が１００％から１０％に達する時間が約４ｍｓであるために、絵素列５３で示すように若干の光漏れが観察されるのである。したがって、従来の画像表示シーケンスでは、白帯５２の幅が明瞭に３絵素分には見えないのである。

【００８２】次に、本実施の形態の液晶表示装置における画像表示動作に付いて説明する。本液晶表示装置では、１フレーム期間内に黒表示を達成できる電圧のリセット信号を各水平ラインのデータ信号書き込み間に書き込むのである。本実施の形態の液晶表示装置における画像表示シーケンスを図１１に示す。尚、図１１(b)に、図１１(a)における書き込みおよびリセット期間の具体的内容を示す。図１１に示すように、本実施の形態においては、データ信号の書き込みとリセット信号の書き込みとをサンプリング周期の１/２周期で交互に行う。その場合、リセット信号の書き込みは、データ信号書き込み水平ラインの１６０本先の水平ラインに対して行うのである。

【００８３】本実施の形態においては、このような画像

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た場合には上記バックライトの輝度を低下させるのである。こうすることによって、常時、動画像に合せたバックライトの輝度に固定しておく場合に比して消費電力を低減することができ、動画表示品位に優れた携帯用の液晶表示装置を必要最小限の消費電力アップで得ることができるのである。

【００９２】尚、上記動画/静止画判別回路２１を設ける代わりに、本実施の形態の画像表示シーケンスと従来の画像表示シーケンスとを選択するスイッチを設け、何れかの画像表示シーケンスをユーザが選択可能にしても差し支えない。そして、本実施の形態の画像表示シーケンス側に上記スイッチが切り換えられた場合には、同期してバックライト調光回路２３によってバックライトの輝度を増加させるのである。この場合にも動画表示品位に優れた液晶表示装置を最小限の消費電力アップで得ることができる。

【００９３】また、上述のごとく、本実施の形態においては各フレーム毎に黒透過率から任意の透過率になる過程と任意の透過率から黒透過率になる過程を含むために、図２１に示すように、書き込み電圧と透過率との関係が従来の画像表示シーケンスの場合とは異なる。また、図２２に示すように、各階調における透過率の経時変化も、本実施の形態の画像表示シーケンスと従来の画像表示シーケンスとで異なる。

【００９４】そこで、これらの結果を考慮して、本実施の形態における画像表示シーケンスを採用した場合には、動画/静止画判別回路２１の判別結果に基づいて信号用基準電源２２によって、各階調における書き込み電圧を、黒表示を基準として振幅を大きく再調整することによって、従来の画像表示シーケンスを採用した場合に比して、良好な階調バランスを得ることができるのである。

【００９５】上述のように、本実施の形態においては、液晶パネル１１としてＶＧＡパネルを用いる。そして、ソースドライバ１２には、ホールディングメモリ３２に蓄えられたデータ信号と黒信号電圧に基づく上記リセット信号との両信号を、１水平ラインサンプリング期間中にソースラインＳに切り替え出力する切替スイッチ３４を設ける。また、４８０本のゲートラインＧを１６０本ずつ３つのグループに分割し、各グループのゲートラインＧを第１ゲートドライバ１３ａ〜第３ゲートドライバ１３ｃに接続する。

【００９６】そして、上記表示制御部２０から第１ゲートドライバ１３ａ〜第３ゲートドライバ１３ｃに、順次半周期ずつ位相が遅れたクロック信号を供給する。さらに、表示制御部２０から、１クロック目と３２１クロック目とに１パルスが存在する走査開始信号を、第１ゲートドライバ１３ａ〜第３ゲートドライバ１３ｃに１６０クロックずつ位相をずらして入力するようにしている。

【００９７】したがって、上記ソースドライバ１２が上

記データ信号を出力する際には、ゲートドライバ１３はｎ番目のゲートラインＧを選択し、ソースドライバ１２が上記リセット信号を出力する際に(ｎ＋１６０)番目のゲートラインＧを選択するように、上記切替クロックと走査開始信号とのタイミングを設定しておくことによって、図１３に示すように、データ信号が書き込まれた絵素には、当該フレームの後半１/３にはリセット信号が書き込まれることになる。

【００９８】その際に、上記リセット信号の電圧(つまり、黒信号用電源２４の電圧)を１フレーム期間内に黒表示を達成できる電圧に設定しおけば、次のフレームまでには黒表示へ戻ることができる。すなわち、本実施の形態によれば、白信号が書き込まれた絵素に対して次のフレームで黒信号を書き込む場合には、前フレームの後半１/３において既に黒信号が書き込まれているために当該フレームの開始時点において透過率が１０％以下を呈し、光漏れは観察されないのである。

【００９９】さらに、動画像における映像のエッジ部は、各フレームにおいて移動と停止とを繰り返す。その場合、人間は上記エッジ部の停止を視認できないために、上記エッジ部は滑らかに移動しているように見える。そして、本実施の形態においては、データ信号が書き込まれた絵素に対してフレームの後半１/３においてリセット(黒)信号が書き込まれて、映像が消えるようになっている。ところが、人間は映像が消えたことを視認できないために、上記映像のエッジ部が人間の視線より先に在る期間と後に在る期間とが短くなり、結果として図２０に示すように動画像のエッジ部の滲みを低減できるのである。

【０１００】また、本実施の形態においては、表示している画像は動画主体の画像か静止画主体の画像かを自動的に判断する動画/静止画判別回路２１を設けている。そして、動画/静止画判別回路２１によって動画像であると判別された場合には、バックライト調光回路２３によってバックライトの輝度を増加させるようにしている。したがって、動画像表示時において、１フレームの後１/３にリセット信号を書き込むために生ずる透過率の低下を、必要最小限の消費電力増加で防止することができるのである。

【０１０１】すなわち、本実施の形態によれば、従来のＶＧＡパネルを備えた液晶表示装置に、最小限の改良を施すことによって、必要最小限の消費電力増加で動画表示品位の向上を図ることができるのである。

【０１０２】尚、上記の動作説明は、動画像表示の場合を例に行っているが、静止画像も表示できることは言うまでもない。静止画像の表示に際しては、表示制御部２０から、全レベルが「Ｈ」の静止画用の切替クロック信号がソースドライバ１２に出力されて、１水平ラインのサンプリング期間全体に渡ってデータ信号のみが出力される。さらに、１パルスが存在する静止画用の走査開始信

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つのゲートドライバ１３によって、シフトしながら１本のゲートラインＧと４本のゲートラインＧとが交互に選択されることになる。

【０１１０】本実施の形態の液晶表示装置における画像表示シーケンスは、図２７に示す通りである。尚、図２７（ｂ）に、図２７（ａ）における書き込みおよびリセット期間の具体的内容を示す。図２７に示すように、本実施の形態においては、データ信号の書き込みとリセット信号の書き込みとを上述のような異なる時間幅で交互に行う。その場合、リセット信号の書き込みは、表示制御部２０からの上述のような識別信号および走査開始信号に基づいて、データ信号書き込み水平ラインの２５６本先から連続した４本の水平ラインに対して同時に行われるのである。

【０１１１】こうすることによって、各水平ラインに、１フレーム中に４回連続してリセット信号を書き込むことができ、図２８に示すように、リセット信号書き込み時間を４．３μｓとしても十分に黒表示を行わせることができる。すなわち、本実施の形態によれば、液晶パネル１１としてＳ－ＸＧＡパネルを用いたアクティブマトリックス型液晶表示装置において、動画表示の滲みや残像を低減することができるのである。

【０１１２】尚、本実施の形態において、上述のごとく、上記データ信号を出力したゲートラインＧの２５６本先のゲートラインＧ（ｍ＝２５６）に上記リセット信号を与えるのは、次の理由による。すなわち、上述したように、液晶の透過率が１００％から１０％まで変化する応答時間は約４ｍｓである。そして、あるゲートラインＧに接続されたある絵素の絵素電極にリセット信号が印加された場合、次にデータ信号が印加されるまでに概ね黒表示になっている必要がある。したがって、次の関係が成立する。

ｆ×ｍ／Ｎ＞４ｍｓ

但し、ｆ：１フレーム時間（１６．７ｍｓ）
Ｎ：総ゲートライン数（１０２４本）

したがって、ｍ＞２４６である必要がある。

【０１１３】ここで、本実施の形態においては、２５６本のゲートラインＧに接続されたゲートドライバ１３を４個一直線状に配置して１０２４本を走査するようになっている。したがって、ｍ＝２５６とすれば、現在データ信号を出力しているゲートドライバ１３の次のゲートドライバ１３から、データ信号が出力されているゲートラインＧの番号と同じ番号のゲートラインＧにリセット信号を出力するという非常に簡単な制御によって、ｍ＞２４６の条件をクリアできるのである。

【０１１４】尚、本実施の形態の場合にも、表示画像が動画主体の画像か静止画主体の画像かを動画／静止画判別回路２１によって自動的に判断し、動画像である場合にバックライト調光回路２３によってバックライトの輝度を増加させれば、動画表示品位に優れた携帯用の液晶

表示装置を必要最小限の消費電力アップで得ることができる。

【０１１５】また、上述の説明においては、ｎ本目のゲートラインＧにデータ信号を書き込んだ後に、（ｎ＋ｍ）本目から連続してｋ本のゲートラインＧにリセット信号を書き込む場合を例に挙げている。ところが、上記リセット信号が書き込まれるＫ本のゲートラインＧを、ｍ本置きにｐ個のグループに分けても差し支えない。その場合に各グループ毎に連続したｋ本（＝Ｋ／ｐ本）に同時にリセット信号が書き込まれることになる。

【０１１６】図２９に、各駆動信号および選択信号のタイミングチャートの一例を示す（ゲートドライバ１３ｄは省略）。また、図３０に１フレーム期間の画像表示シーケンスを示す。尚、図２９は、ｍ＝２５６，ｐ＝２，ｋ＝１の場合の例である。

【０１１７】上述のように、ｍ本置きにｐ個のグループに分散してゲートラインＧにリセット信号を書き込むことによって、以下のような効果を奏することができる。すなわち、液晶は、リセット信号の書き込み開始によって黒表示へ応答し始め、その誘電率が次第に変化して行く（液晶の誘電率異方性のため）特性を有している。したがって、液晶へ所定のリセット電圧を印加しても、その誘電率変化によって液晶に実際に印加されている電圧は変動してしまう。

【０１１８】ところが、ｍ本置きにｐ個のグループに分散させてｋ本のゲートラインＧにリセット信号を供給することによって、ある１本の水平ラインに着目すると、ｍ本走査される毎に１回リセット信号が供給されることになる。すなわち、１回目のリセット信号で液晶がある程度応答してその誘電率が変化する。そして、ｍ本走査後に、上記誘電率が変化した液晶に対して２回目のリセット信号の供給が行われることになる。したがって、この動作をｐ回繰り返すことによって、より確実な黒表示を得ることができるのである。

【０１１９】言い換えれば、液晶素子への信号供給は、信号電圧の個々の絵素容量への印加動作（すなわち充電動作）である。したがって、液晶は、表示の内容（配向状態）によってその誘電率が変化することになり、前回の表示内容によって充電電荷量が異なることになる。したがって、同じ絵素に同じ信号を供給しても、前の表示内容が異なると異なった表示になってしまうのである。

【０１２０】ところが、上述のように、ｍ本のゲートラインＧが走査されるだけの時間をおいてｐ回繰り返してリセット信号を書き込むことによって、上述の誘電率変化の問題を改善することができ、さらに良好な黒表示を得ることができるのである。

【０１２１】＜第３実施の形態＞第１実施の形態における液晶表示装置においては、低温下で使用すると液晶の応答速度が遅くなるために、リセット信号による黒表示が完了する前に次フレームのデータ信号が書き込まれる

が黒画像表示に不十分な時間である場合でも、複数回繰り返して黒表示信号を供給することによって確実に黒表示を行うことができる。

【０１３３】したがって、この発明によれば、表示パネルの絵素密度が高密度であって行線数が多いために、黒表示信号供給時間を十分取れない場合でも、バックライトの光り漏れや映像エッジ部での光の滲みが起きない高品位な動画表示を、最小限の変更によって行うことができる。

【０１３４】また、上記第２の発明の液晶表示方法は、上記複数の行線を(n＋α・m)(α＝１，２，…，p)本目の行線とすれば、ある１本の水平ラインに関してm本の走査毎に黒表示を繰り返して行うことができる。したがって、直前のフレームにおける表示内容による絵素容量の誘電率の変動を無くして、さらに高品位な表示を行うことができる。

【０１３５】また、上記第２の発明の液晶表示方法は、上記複数の行線を(n＋α・m)本目から(n＋α・m＋k－１)(α＝１，２，…，p)本目までの行線とすれば、ある１本の水平ラインに関してm本の走査毎にk回繰り返して、黒表示を行うことができる。したがって、直前のフレームにおける表示内容の影響をさらに無くすことができる。

【０１３６】また、上記第１の発明あるいは第２の発明の液晶表示方法は、上記データ信号の供給時間と上記黒表示信号の供給時間とを等しくすれば、非常に簡単な切り換え制御処理によって、上記データ信号の供給と上記黒表示信号の供給を切り換えることができる。

【０１３７】また、上記第１の発明あるいは第２の発明の液晶表示方法は、上記データ信号の供給時間を上記黒表示信号の供給時間よりも長くすれば、表示パネルの絵素密度が高密度であって行線数が多いために、データ信号供給時間を十分に取れない場合にも対処することができる。

【０１３８】また、上記第１の発明あるいは第２の発明の液晶表示方法は、上記mの値を次式の関係を満たすように設定すれば、１フレーム期間における上記黒表示信号の供給時間を、白表示を黒表示へ切り換える場合の液晶の応答時間以上に設定することができる。したがって、上記データ信号に基づいて白画像が表示される絵素であっても、次にデータ信号が印加されるまでに確実に黒表示を行うことができる。

$$f \times m/N > t$$

但し、N：行線数

f：１フレーム時間

t：白表示を黒表示へ切り換える際における液晶の応答時間

【０１３９】また、上記第１の発明あるいは第２の発明の液晶表示方法は、上記kの値を次式の関係を満たすように設定すれば、１フレーム期間における上記黒表示信号の供給時間を、黒表示信号のk回供給によって白表示を黒表示に切り換えることができる最短時間以上に設定できる。したがって、上記黒表示信号の供給時間が不充分であるために黒表示信号供給をk回繰り返して供給する場合に、上記データ信号に基づいて白画像が表示される絵素であっても、次にデータ信号が印加されるまでに確実に黒表示を行うことができる。

$$T \times k \geq T_0$$

但し、T：黒表示信号の１回の供給時間

T_0：白表示を完全に黒表示に切り換えることができる黒表示信号の最短時間

【０１４０】また、上記第１の発明あるいは第２の発明の液晶表示方法は、上記データ信号が黒表示用のデータ信号である場合の電圧Vdと上記黒表示信号の電圧Vrとを、下記の関係を満たすように設定すれば、上記黒表示信号の供給時が不足して十分な黒表示が行えない場合でも、確実に黒表示を行うことができる。対向電極の電位レベルに対して正極性の場合には

ノーマリホワイト時はVd＜Vr、ノーマリブラック時はVd＞Vr

対向電極の電位レベルに対して負極性の場合には

ノーマリホワイト時はVd＞Vr、ノーマリブラック時はVd＜Vr

【０１４１】また、第３の発明の液晶表示装置は、表示制御部からの制御信号によって、列線ドライバの切替スイッチがデータ信号を選択している際には、行線ドライバはn本目の行線に選択信号を供給する一方、上記切替スイッチが黒表示信号を選択している際には、上記行線ドライバは(n＋m)本目の行線に選択信号を供給するので、総ての絵素に対して、データ信号を書き込み、さらにmに応じた所定時間が経過した後に黒表示信号を供給し、次のフレームに新たに画像データ信号が書き込まれるまで上記黒表示信号が書き込まれた状態を保持して、黒画像を表示できる。したがって、白表示を行っている絵素を次のフレームで黒表示に変える場合には、次のデータ信号が書き込まれる前に既に黒画像が表示されていることになり、バックライトの光り漏れを防止できる。

【０１４２】すなわち、この発明によれば、上記列線ドライバに切替スイッチを設けて上記表示制御部からの制御信号を変更するという最小限の変更によって、動画表示品位を向上できるのである。

【０１４３】また、第４の発明の液晶表示装置は、表示制御部からの制御信号によって、列線ドライバの切替スイッチがデータ信号を選択している際には、行線ドライバはn本目の行線に選択信号を供給する一方、上記切替スイッチが黒表示信号を選択している際には、上記行線ドライバは上記n本目とは異なる複数本の行線に選択信号を供給するので、上記黒表示信号供給時間が１回の黒表示信号供給だけでは十分な黒画像表示を行えない時間の場合でも、黒表示信号供給を複数回繰り返して確実に

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きる。

【０１５４】また、上記第３の発明あるいは第４の発明の液晶表示装置は、バックライト調光手段によって、上記指令信号に基づいて上記第１表示モードと第２表示モードとでバックライトの輝度を切り換えるようにすれば、液晶の透過率が低くなる第１表示モードの場合に上記バックライトの輝度を上げることができる。したがって、上記バックライトの輝度を上記第１表示モード時に合せて固定しておく場合に比して、上記第２表示モード時におけるエネルギーの浪費を防止できる。

【０１５５】また、上記第３の発明あるいは第４の発明の液晶表示装置は、上記黒表示信号発生手段としての黒表示信号用電源の電圧を、上記第１表示モード時と第２表示モード時とで切り換えるようにすれば、第１表示モードと第２表示モードとの間で一定の階調バランスを保つことができるようになる。

【図面の簡単な説明】

【図１】　この発明の液晶表示装置における概略構成を示す図である。

【図２】　図１におけるソースドライバの概略構成を示す図である。

【図３】　図２とは異なるソースドライバの概略構成を示す図である。

【図４】　図１におけるゲートドライバの概略構成を示す図である。

【図５】　図４におけるアナログスイッチが動作した場合の説明図である。

【図６】　第１実施の形態における３つのゲートドライバの駆動信号および各ゲートラインに出力される選択信号のタイミングチャートである。

【図７】　動画像表示動作の説明に用いる画像の説明図である。

【図８】　従来の画像表示シーケンスを示す図である。

【図９】　図７に示す画像において生ずる滲みの説明図である。

【図１０】　従来の画像表示シーケンスに基づく白帯絵素における各フレーム毎の透過率変化を示す図である。

【図１１】　図１に示す液晶表示装置における画像表示シーケンスを示す図である。

【図１２】　図１１に示す画像表示シーケンスに基づく図７に示す画像の表示結果を示す図である。

【図１３】　図１１に示す画像表示シーケンスに基づく各フレーム毎の透過率変化を示す図である。

【図１４】　図７に示す画像の任意の水平ラインにおける白帯の移動の様子を示す図である。

【図１５】　液晶の応答時間を無限小とした場合の従来の画像表示シーケンスにおける透過率の応答波形を示す図である。

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【図１６】　液晶の応答時間を無限小とした場合の図１１に示す画像表示シーケンスにおける透過率の応答波形を示す図である。

【図１７】　従来の画像表示シーケンスでの白帯の移動と人間の視点の移動とを示す図である。

【図１８】　図１７に示す白帯の移動と人間の視点の移動とのずれに起因して白帯の両エッジの輝度が低下する状態を示す図である。

【図１９】　図１１に示す画像表示シーケンスでの白帯の移動と人間の視点の移動とを示す図である。

【図２０】　図１９に示す白帯の移動と人間の視点の移動とのずれに起因して白帯の両エッジの輝度が低下する状態を示す図である。

【図２１】　図１１に示す画像表示シーケンスと従来の画像表示シーケンスとにおける書き込み電圧と透過率との関係を示す図である。

【図２２】　図１１に示す画像表示シーケンスと従来の画像表示シーケンスとにおける各階調での透過率の経時変化を示す図である。

【図２３】　図６とは異なる駆動信号および選択信号のタイミングチャートである。

【図２４】　図１１とは異なる画像表示シーケンスを示す図である。

【図２５】　第２実施の形態における駆動信号および選択信号のタイミングチャートである。

【図２６】　図２５に続くタイミングチャートである。

【図２７】　図１１および図２４とは異なる画像表示シーケンスを示す図である。

【図２８】　図２７に示す画像表示シーケンスに基づく各フレーム毎の透過率変化を示す図である。
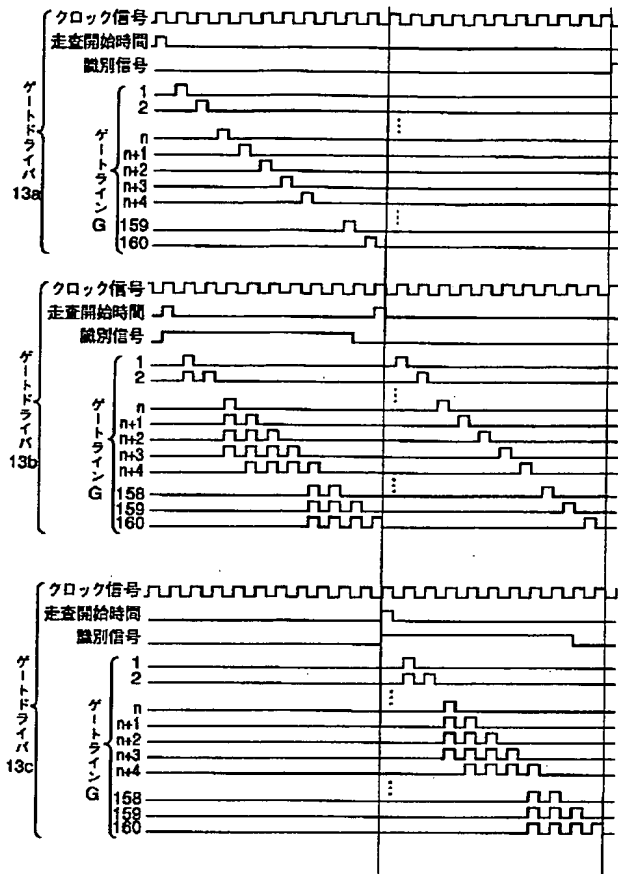
【図２９】　図２５とは異なるタイミングチャートである。

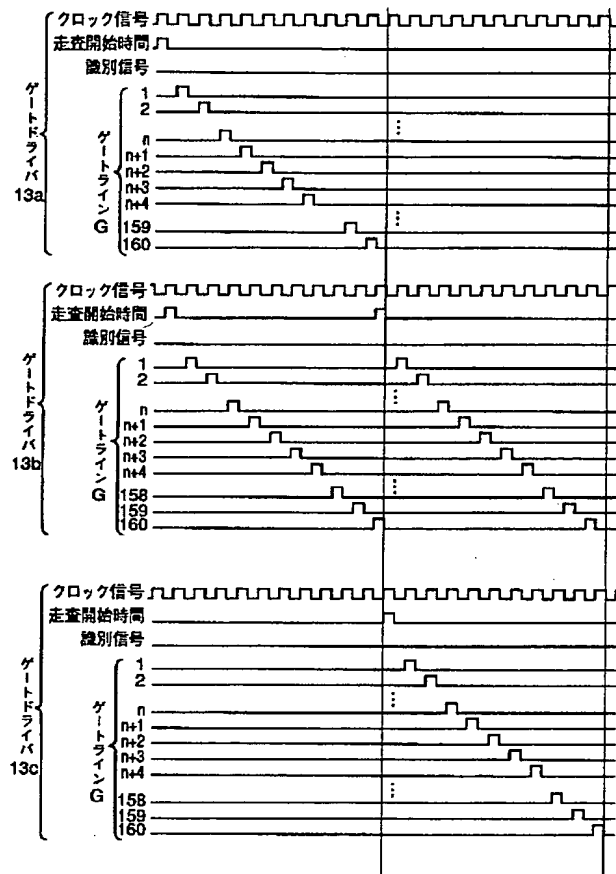【図３０】　図２９の画像表示シーケンスを示す図である。

【図３１】　従来の液晶表示装置におけるソースドライバの概略構成図である。

【符号の説明】

１１…液晶パネル、１２…ソースドライバ、
　　１３…ゲートドライバ、２０…表示制御部、
　　　　２１…動画/静止画判別回路、２２…信号用基準電源、　　　　　　２３…バックライト調光回路、２４…黒信号用電源、　　　　　３１,３７…サンプリングメモリ、３２,３８…ホールディングメモリ、　　３３,３８…DAコンバータ、３４,３５…切替スイッチ、　　　　　　３６…黒信号データ生成部、４１…シフトレジスタ、　　　　　　４２…出力回路、４３…アナログスイッチ。

【図５】

【図６】

【図１１】
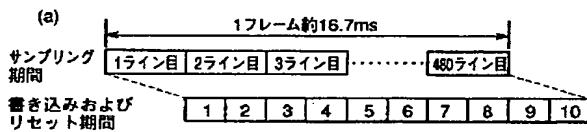
(a)

(b)

番号	駆動状態	
1	1ライン目データ	信号書き込み
2	161ライン目リセット	信号書き込み
3	2ライン目データ	信号書き込み
4	162ライン目リセット	信号書き込み
5	3ライン目データ	信号書き込み
6	163ライン目リセット	信号書き込み
7	nライン目データ	信号書き込み
8	(160+n)ライン目リセット	信号書き込み
9	480ライン目データ	信号書き込み
10	160ライン目リセット	信号書き込み

【図１２】
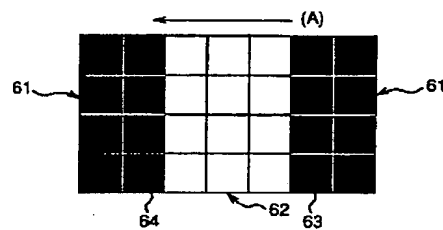
【図１４】
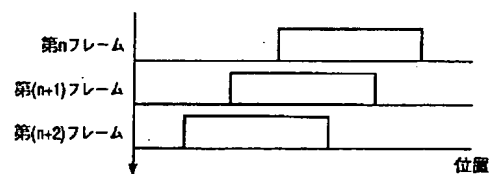
【図２２】
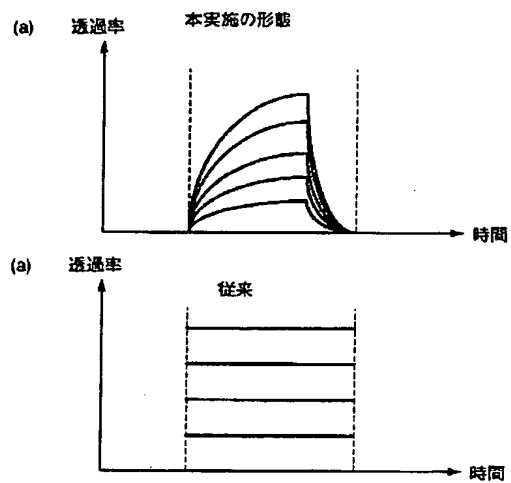
【図２３】
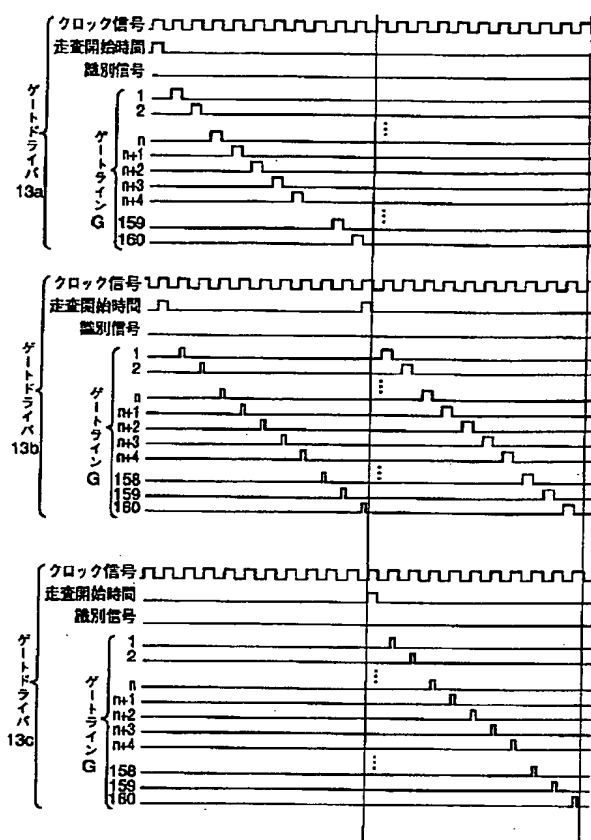
【図２６】
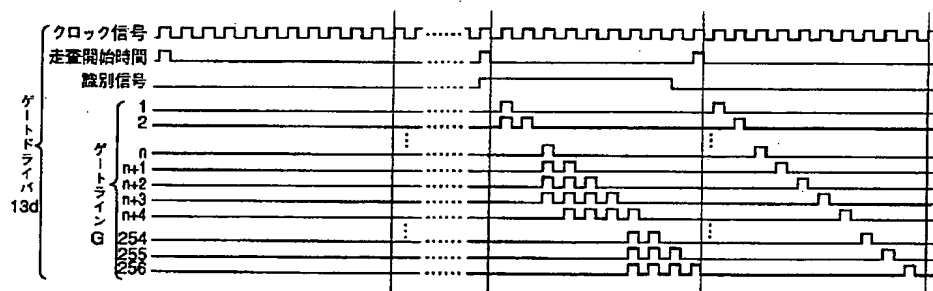
【図３１】
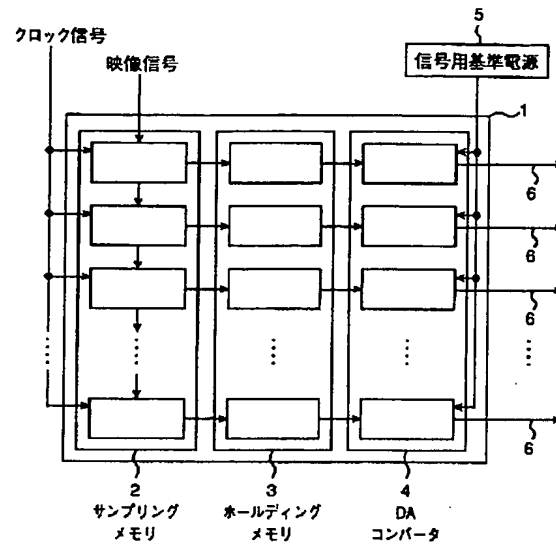
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(51)Int.Cl.^{7}		識別記号	F I		テーマコード (参考)
Ｈ０４Ｎ	5/66	１０２	Ｈ０４Ｎ	5/66	１０２Ｂ